THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1609.] LONDON, MARCH 13, 1894. [46TH YEAR. PRICE 6d.

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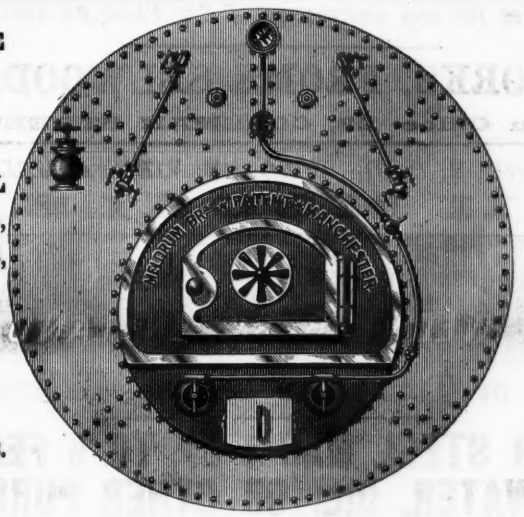

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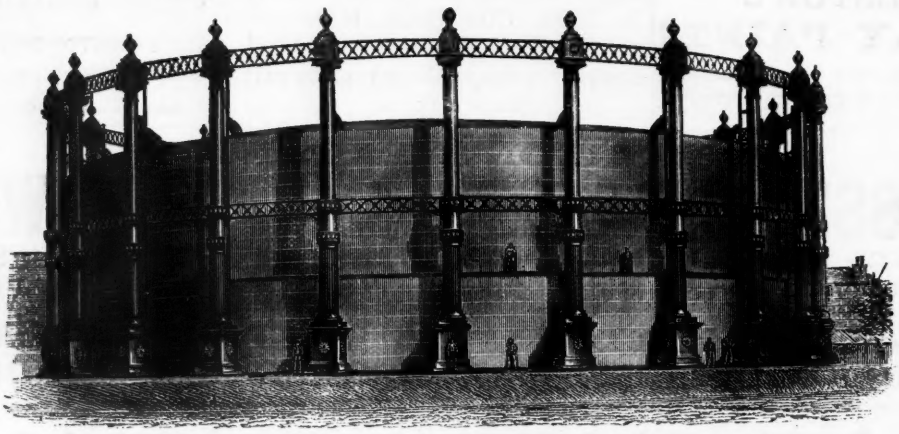

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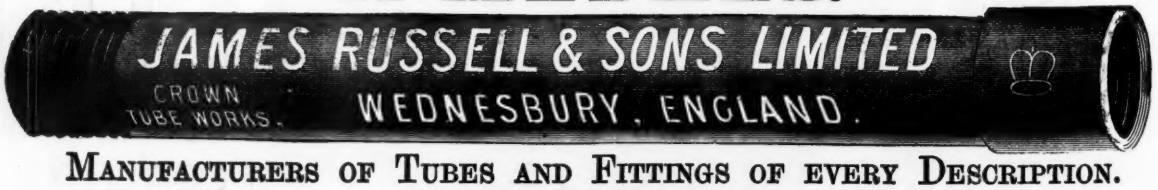

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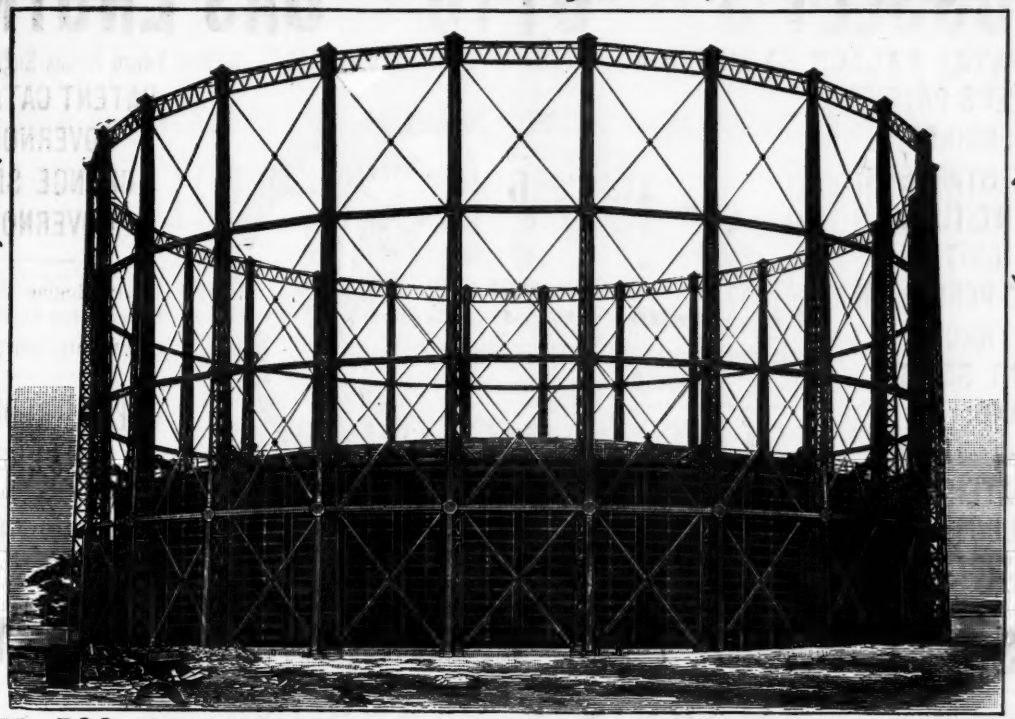

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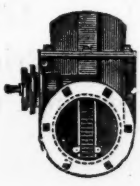

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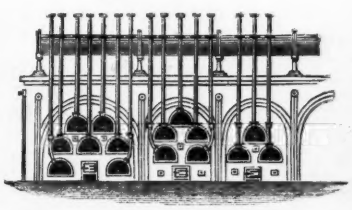

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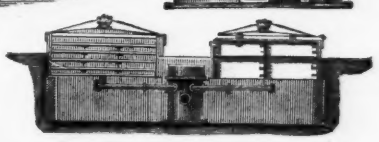

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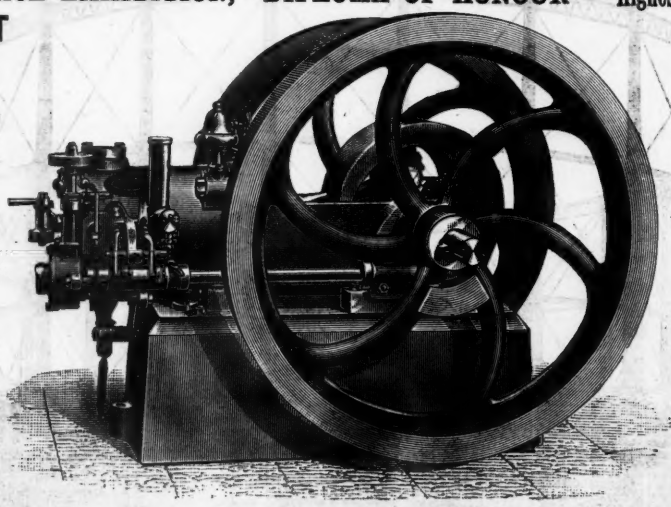

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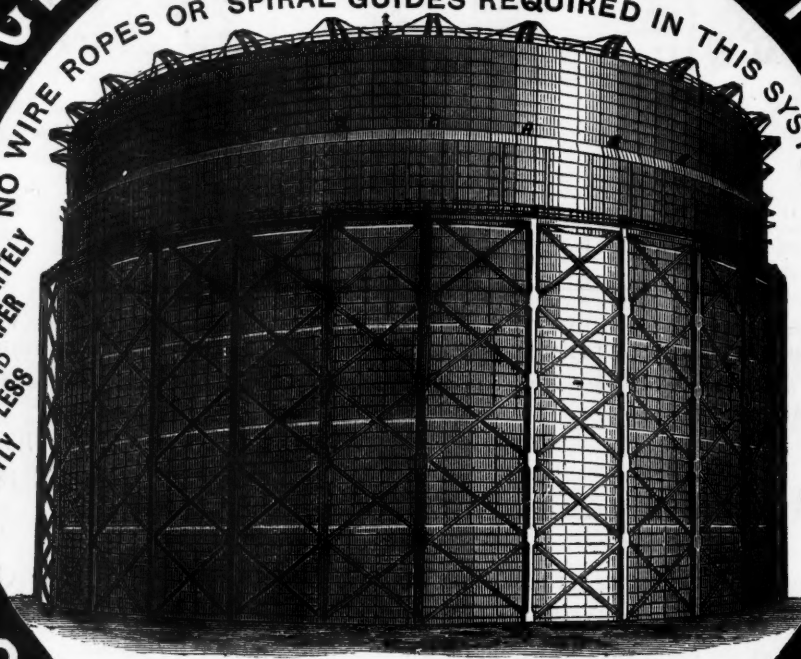

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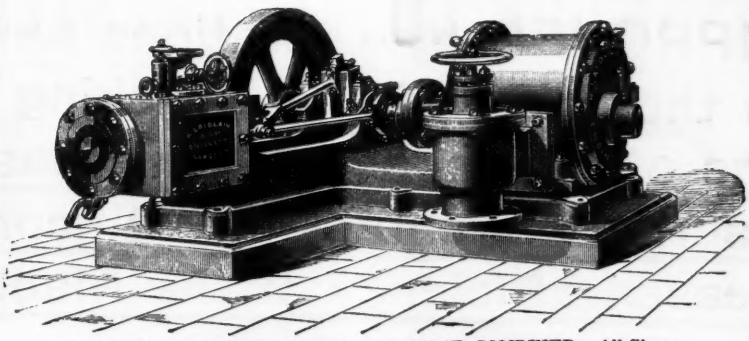

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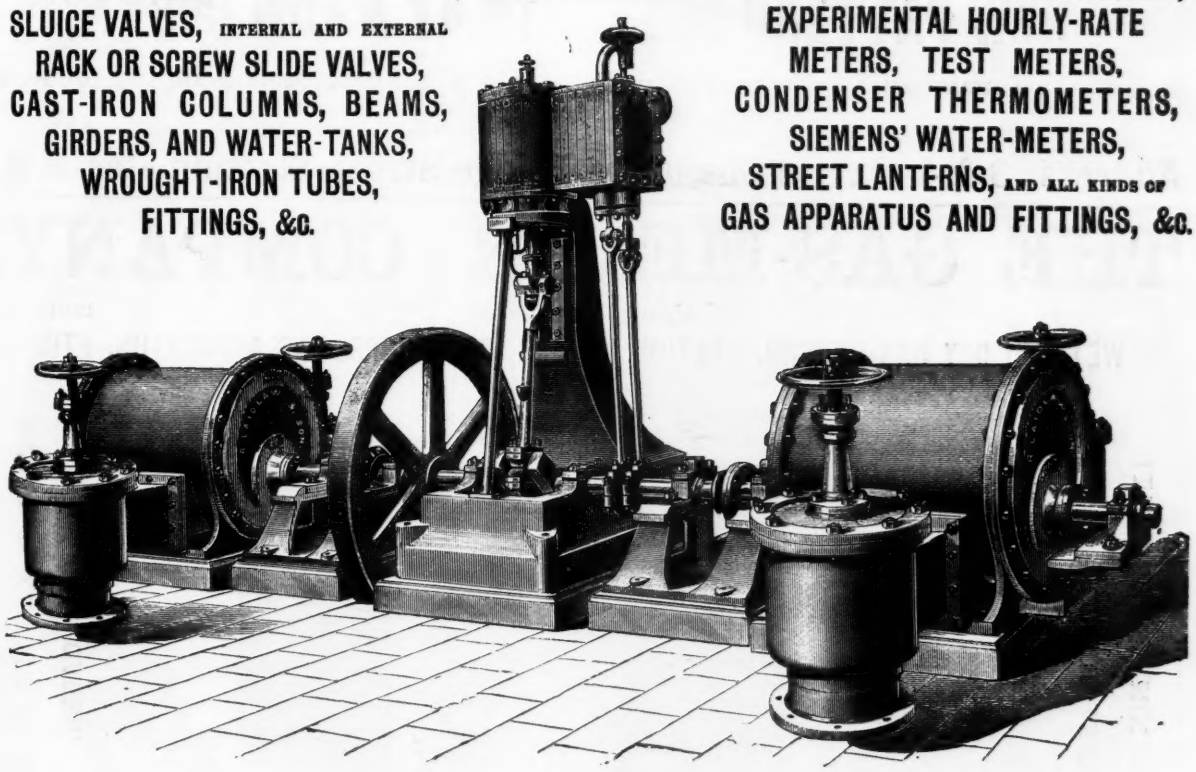

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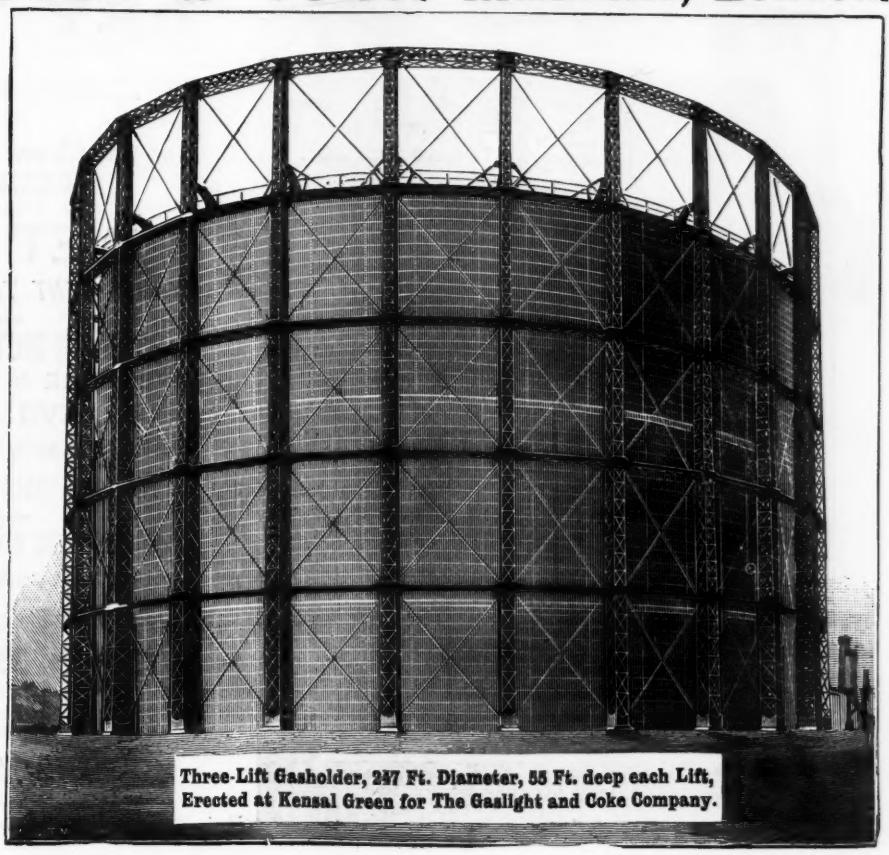

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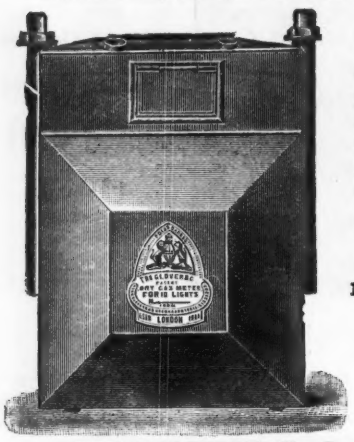

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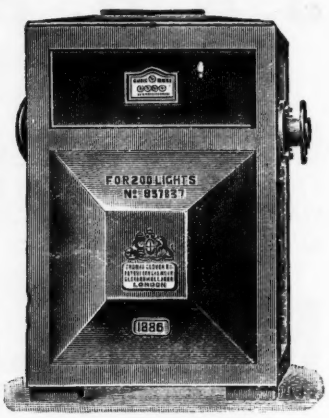

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TUESDAY, MARCH 13, 1894.

Misrepresentation and Support.

MR. MACKENZIE is a gentleman of "credit and renown" in Edinburgh, and is, moreover, a personage of light and leading in the Town Council of his city; wherefore we have been led to pay special attention to a long speech reported to have been made by him in support of the scheme of charges for the electric lighting service to be supplied by the Corporation, in which he referred somewhat particularly to the JOURNAL. In this address, Mr. Mackenzie, after the manner of his nation, took nothing for granted, but gave the Edinburgh Town Council a severely doctrinal lesson as to the electrical supply undertaking on which the city has embarked—showing how a profit may or may not be secured by the working of the venture. We have nothing to say against the bulk of Mr. Mackenzie's speech, which was, indeed, highly creditable to him. With refer ence to one point, however, we must here enter a protest, and must ask Mr. Mackenzie to take note of it, which, as it is a question of his having misrepresented us, he will doubtless do in the proper fashion. It was with regard to the comparative cost of electric and gas lighting—as to which, by the way, there is no uncertainty in the minds of those people who have tried both. Mr. Mackenzie referred to our having reproduced from the *Electrician* certain articles bearing upon the subject; and he went on to say that, since we did not contradict the conclusions arrived at by the author of these articles, these "may be assumed as "fairly accurate." Mr. Mackenzie has been rather hasty in forming this opinion—or, to put the matter more bluntly, his reading of the JOURNAL is occasionally slightly in arrear. If he had taken the trouble to glance through our issue dated the 27th ult., which, as he spoke at a Town Council meeting on the 6th inst., he might have easily done, he would have been saved from falling into an error which he must now regret; for in that number we expressed our opinion of the conclusions in question, and it is far from justifying Mr. Mackenzie's assumption. Surely, it must be obvious to all our regular readers that we cannot fairly be held as endorsing all the technical matter that is gathered up week by week within our columns for its own sake, and always ascribed to its proper source. It is quite enough to be responsible for the editorial comments which are offered in the portions of the JOURNAL appropriated to this order of matter; and as in these we endeavour to do justice, it is not too much to ask that justice may be shown to us by whoever desires to quote from our pages for any purpose of his own. However, we have no serious quarrel with Mr. Mackenzie, who will know all about the comparative cost of electric and gas lighting if he lives a year or two longer. Indeed, we are indebted to another portion of this gentleman's speech for something that comes in useful as support for a view which we recently expressed in regard to Liverpool gas, respecting the way in which "familiarity breeds contempt" of high-illuminating power. Mr. Mackenzie asserted that "the unfortunate thing is that nobody believes our gas is "of such high candle power; the universal comment being "that it is the worst gas in the country." Either Mr. Mackenzie was speaking in this regard with a flippancy altogether unbecoming a town councillor of Edinburgh, or his words must be good evidence against the notion (which we do not ourselves believe) that there is any connection at all between a high illuminating power in a gas supply and popular contentment with it. It appears to be fairly arguable that if a standard of 27 candles or thereabouts can be dismissed in the way Mr. Mackenzie dismisses it, as a fiction of analysis, the attempt to satisfy the public by this means may as well be given up as hopeless.

The Gas Supply of Manchester—A Stupid Libel.

AN animated controversy on the gas supply of the city is going on in the Manchester newspapers, with the usual tendency of popular discussions of the kind to wander off into a maze of side-issues where the original matter in dispute is in danger of being lost. As our observations on the subject have been freely quoted by local critics, who, while dissatisfied with the results of the administration of the Gas Department by the Corporation Committee, have not felt themselves equal to the task of distinguishing where mistakes have been made, it will be as well if we repeat here that our impeachment of the administration is a perfectly general one. Nobody outside the Gas Committee, who have barely succeeded in voting confidence in themselves, can seriously pretend that the results of the management of the fine Manchester gas undertaking by this body are such as the local public ought to be contented with or the Committee to be proud of. A searching investigation into the condition and administration of the undertaking would be required to demonstrate in detail the deficiencies of either; and such an inquiry can only be hopefully conducted by a competent and impartial Commission. If the Committee truly desire to justify themselves in the eyes of their fellow-citizens, they will quell the inconclusive newspaper controversy by asking the Corporation to appoint such a Commission, and will aid its investigations to the fullest extent of their knowledge and power. If the Committee affect to rest contented with the meagre whitewashing that they have recently received, the local and technical public will not be slow to suspect the various Chairmen and Deputy-Chairmen

of the Sub-Committees and those who have controlled what must, for the sake of politeness, be called the policy of the Gas Department, of a desire to cling to power even though the interest of the city should suffer thereby. Alongside of the financial question, there has arisen a decidedly acrimonious dispute over the alleged sulphurous impurity of the gas supplied by the Department. It is only to be expected that some tartness should attend a discussion as to whether or not an undue amount of sulphuric acid is added to the air of Manchester interiors as a result of the combustion of gas therein. Some inquirers of a chemical turn recently published certain alarming statements of what is or might be the condition of the air in gas-lit apartments when all the sulphur in the products of combustion of the gas is oxidized to sulphuric acid. This, as is known to chemists who have looked into the subject more carefully, does not, in point of fact, happen; but we are far from accepting the extreme conclusion that on this account it does not matter how much sulphur impurity the gas contains. It may be a sentimental opinion that the public have a right to as pure a supply of gas as can be given by works proportioned and managed in accordance with the best modern practice; but we would rather support this view than the other, which is too often used as a cover for lax and stupid management. People are very fond of "throwing stones" at gas; and only the other day we noticed in a so-called technical publication a silly diatribe against the incandescent gas-burner, which is such a thorn in the side of electricians. It declared that "incandescent is cheaper "than ordinary gas light, mainly because it makes greater "draughts (*sic*) upon the oxygen of the air." For this astonishing reason, incandescent gas-lamps were denounced as "the most noxious light for indoor illumination that the "century has hit upon." While such foolishness passes current in the newspaper press, it behoves gas manufacturers to protect their rear by removing, so far as they are able, all ground for even the most sentimental complaints against the excellence of their product.

The Employers' Liability Bill in the Cold.

According to present arrangements, and weather permitting, the associated Trades Unionists of London are to assemble in their thousands in Hyde Park next Sunday, with the object of denouncing the House of Lords for having caused the abandonment of the Employers' Liability Bill. The Upper Chamber of the Legislature, failing to capitulate before the overwhelming Government majority of two, are to be thundered at by all the elemental force at the command of Mr. John Burns and his stock company of mass-meeting orators. Doubtless, as the *Daily Chronicle* opines, Lord Salisbury and his aristocratic following are shaking in their shoes at this prospect. The childlike faith of the New Democracy in the validity of mass meetings and in the power of the stage army of its pet demagogues, is touching in the extreme. It is possible that the spirit of Sunday's meeting may be slightly damped by the strategic movements within the Administration which have resulted, since the programme was issued, in the substitution in the Premiership of a member of the House of Peers for the Great Commoner who might have looked benignantly upon the action of those who, while calling themselves Labour leaders, are in no way distinguishable from other "Gladstonian items." The greatest of all dampers, however, would be a wet afternoon; for a good soaking shower would wash away the party of opposition to the House of Lords, with the possible exception of the few capitalists on this side who might be found in possession of mackintoshes and umbrellas. The temper in which the New Unionists are inclined to "discuss" the question at issue was shown during the past week at a meeting called in the democratic region of Bermondsey to hear the Earl of Dudley explain the motives of his own action in regard to the crucial point of the now defunct Bill. The hall was stormed by a riotous mob, who prevented the object of the meeting from being carried out, and cleared the platform. Of course, the mob had no leaders while this was going on; but, curiously enough, as soon as the hall was in their possession, several of the stock company of agitators who are in Sunday's bill turned up, and improved the occasion. The humorous thing about these proceedings is the impudent assumption on the part of the New Democracy that nobody sees through them.

Mr. Asquith on Local Self-Government.

The flourishing Association of Municipal Corporations gave their annual dinner last Friday, when Mr. Asquith was the guest of the evening, and responded for Her Majesty's Ministers in one of those happy speeches which have helped so greatly in building up the Home Secretary's high reputation. The speaker resisted the great temptation to indulge in mere adulation of the idea of Municipalism; while he said all that could have been desired by his hosts in recognition of the grand part played by British Corporations and Local Authorities in bringing home to the people a proper sense of the responsibilities of self-government. The cleverest parts of Mr. Asquith's speech were the adroit passages in which the practical freedom of municipal institutions in the United Kingdom was reconciled to the paramount need for legislative checks and administrative control. Some popular politicians have undertaken to embrace and defend the doctrine that since municipal bodies must be supposed to know best what is good for their own districts, they ought to be allowed a free hand to carry out whatever measures they may adopt in the interest of their locality. The Home Secretary knows better than this. He reminded his hearers that, in certain matters, the energy and freedom of action of Municipalities are restricted by the necessity of appealing for the sanction and support of central Government Departments, and even of Parliament; and he gave no hint of his entertaining any doubt of the justice or expediency of such a limitation of local option. Financial questions, questions about bye-laws, and the reform of local constitutions, very frequently give rise to collisions between Municipalities and Government Departments, or Parliamentary Committees. And in this regard, Mr. Asquith confessed that "the curiously loose "and ill-defined connection that exists between the Municipalities and the Central Government is one which it "would be difficult to justify in abstract theory. There "is no architect of a paper-constitution who would not "be shocked by its want of symmetry and method." This is quite true; but here once more comes in the English way of working out our practical problems as we go along, by the excellent method of give and take and by the exercise of common sense, as to the results of which Mr. Asquith said, "though it might be difficult to formulate a theory of the relations between the Municipalities "of the country and the Central Government, and still "more difficult to justify that theory by any reference "to the systems of philosophers, in practice we have come "as near to the solution of one of the most difficult "problems of social life as any other country in the "world." The Home Secretary repudiates the careless comparison sometimes made of his own position with that of a Minister of the Interior in France or some other country. He has no desire for a centralized system which would impose a uniform method of action upon our free self-governing communities; and he declares that "what "we want in this country is that every community, however small, however large, should have an articulate, a "freely-chosen, and responsible organ for the expression "of the wishes of those whom it represents, and for the "carrying out of their wishes in all matters peculiarly "affecting themselves." These be wise words; and it is to be hoped the aspiration they convey will be gratified.

The Prospects of Peace in the Coal Trade.

As the year wears on, the expectation of a renewal of strife by the coal miners fades away. Nobody can pretend to know anything definite concerning the position and prospects of either of the parties concerned in the coal trade—most of them do not themselves know how they stand. But there is reason to believe that both masters and men will be glad if the trade can maintain its actual position, and that neither side will be able to stand out long against whatever course the trade may take. The employers have been talking about forming "rings," and the miners have discussed the restriction of the output; and neither proceeding is to be regarded as an indication of strength. There may be a recommencement of disturbance in the mining districts, because of the remarkable fact that so many of those who have the power to upset the men's minds are profoundly ignorant of the first principles of industrial economy. It is a sad thing that one of the largest of the industrial interests of the kingdom should be exposed to the influence of men who talk as though they do not understand how the smallest huckster's

trade is governed. But such is unhappily the fact. We are told, by reporters who ought to know, that many collieries are even now being worked at a loss, that some of the most productive pits are running short time, and that there are large numbers of miners unemployed. What, in these circumstances, are the heads of the Miners' Federation to do? Short time and a restricted output are the usual panaceas recommended by Mr. Pickard and his like to remedy the two evils of lack of employment and low wages; but what if these conditions are still found to exist, and the beneficial result imagined to flow from them yet remains unrealized? Naturally Mr. Pickard would say it is all the fault of the colliery proprietors—that they ought to employ more men, and pay high wages. But supposing there is a deficiency both of trade and money, what is to be done? For an answer to this query, we must turn to the teachings of the orthodox economists; and, unfortunately, this is just where miners' leaders will not go for guidance.

Company v. Municipal Supply Undertakings.

In the current number of our contemporary the *Electrician* will be found an exceedingly weighty article upon the subject of municipal electric lighting loans and their repayment, with particular reference to the St. Pancras case. It is satisfactory to find that this authority does not uphold the ambitious North London parish Vestry in its extravagant folly, and points out that the question as between the conduct of industrial and supply undertakings by private companies or by local authorities should not be determined in favour of the latter by the consideration that money can be raised upon the security of the rates at a low figure for long periods. Now, this is precisely the ground upon which advocates of the municipalization of gas undertakings mainly rest their case. A gas undertaking is, of course, a less speculative venture now-a-days than an electric lighting venture. The time may come when electric lighting will be as safe a business as gas supply is to-day; but the real question will always remain, when the choice comes to be made between a public and a commercial undertaking of either kind, of which system is capable of yielding the best results. Supposing municipal and private administration to be equally good—a large assumption—it is evident that the cost of capital will be the next consideration affecting the issue. On this point, our contemporary remarks: "If "an inferior runner is given sufficient start, he can always "win the race. In the same way, if municipalities, by legis- "lative favours and otherwise, are only placed in a suffi- "ciently advantageous position to start with, they will no "doubt be able to make a better showing than their ham- "pered rivals, the private capitalists." The argument goes on to show that "if there be any real virtue in "municipalizing electric light undertakings, then it can "only arise from the fact that local authorities can really "and truly turn out the Board of Trade unit cheaper "than can limited liability companies." This contention obviously applies to gas undertakings as well as to the class of business named. The article concludes with the pregnant observation that "the march of events is not "likely to be arrested by the fact that it will cause con- "siderable inconvenience to a London Vestry which has "venturesomely embarked a large sum of the ratepayers' "money on an undertaking which must, by the very nature "of it, be more or less of a business speculation, and which "would have been on that account far better left in the "usual hands." We are not going to raise again, in this connection, the ticklish question of whether gas undertakings under the control of local authorities are better or worse managed than those belonging to companies; but we do say this—that, quite apart from the matter of street control, the financial advantage is the only point of expediency which remains to local authorities desirous of acquiring gas property; and this has been reduced to insignificance by modern improvements in gas companies' finance. It would be a good subject for a paper to take the case of a particular gas undertaking, which need not be named, working out the results of cheapening and consolidating its capital stock, supposing also one-third of the amount to be borrowed, and comparing these with the results of a transfer of the property to municipal ownership upon ruling terms. Unfortunately for the municipal case, there are examples to show clearly that a small capital burden may be of no benefit to the public.

WATER AND SANITARY AFFAIRS.

Objections are taken to the Bill of the Southwark and Vauxhall Water Company, on the ground that it proposes the carrying out of a scheme at variance with the larger project devised by Messrs. Hunter and Fraser, and approved by the Royal Commissioners as the best which had been laid before them in respect to a water supply from the Thames. Mr. Brayley Hodgetts is particularly warm on this point, and in a letter to *The Times* accuses Sir Henry Knight of making a "grossly misleading" assertion, in stating that the scheme propounded in the Southwark and Vauxhall Bill was intended to carry out the recommendations made by the Commissioners. Mr. Hodgetts understands those recommendations to mean the adoption of Messrs. Hunter and Fraser's plan for the establishment of reservoirs at Staines. But it should be remembered that, in the degree to which the Commissioners approved of this plan, they spoke guardedly, in these words: "Broadly speaking, and without committing "ourselves to details, we may say that the conception of "this Staines scheme of storeage commends itself to us "as the best which has been suggested." The Southwark and Vauxhall plan was not before the Commissioners during their inquiry, or there is every probability that it would have received a measure of approbation. The position is now reversed. The Southwark and Vauxhall plan is before Parliament; but the Staines scheme is not. Mr. Hodgetts writes both in *The Times* and in the *Engineer*, denouncing the Southwark Company for seeking to overthrow the project for the larger undertaking at Staines. But if the Southwark and Vauxhall scheme had not been brought forward, where would the Companies be at the present hour? So far as a supply from the Thames is concerned, the way would be left open for the County Council to press their London Water Bill as absolutely necessary to protect London from a water famine. The Council could plead that the Thames Companies were doing nothing; whereas, as Mr. Binnie has himself reported, "the fact that London must continue "for ten or fifteen years longer to be supplied from the "Thames and Lea is undoubted,"and at the same time the Southwark and Vauxhall Company "have exhausted their "parliamentary powers as to the quantity which they "are authorized to draw from the Thames, as well as the "extent of the works and the amount of money they are "entitled to spend." Mr. Binnie ascribes to the East London Company the same predicament; and he is so impressed by the state of the case as to declare, as we mentioned last week, that "mere opposition to the "applications of the Companies by the Council must be "followed by certain and ignominious defeat." Yet this opposition is what Mr. Hodgetts proposes in the case of the Bill of the Southwark and Vauxhall Company.

Speaking of the volume of water which the Southwark and Vauxhall Company are taking from the Thames, Mr. Hodgetts says, after the manner of Mr. Binnie, that the Company "have practically reached their limit." By a singular contradiction of himself, Mr. Hodgetts immediately argues: "There is, therefore, no obvious urgent "reason for the Southwark and Vauxhall Company to "increase their supply from the Thames." It would surely be more reasonable to say that an "obvious urgent "reason" for enlarged resources was "therefore" distinctly proved. If the great combined scheme, to cost ten millions sterling, is not forthcoming, it is necessary that something else should be produced. Mr. Hodgetts says in the *Engineer* that "all the plans are ready" for the Staines scheme. He evidently knows something about it; and perhaps he will tell us why the plans have not given birth to a Bill. At the time when Mr. Francis Tagart made an important speech in support of the Staines scheme while presiding over a meeting of the Grand Junction Company, we remarked that it was "impossible "to shut out from view" the plan embodied in the Bill of the Southwark and Vauxhall Company. We also suggested whether "the lesser scheme might be taken as "an instalment of the larger one." As it is not intended that the nine reservoirs at Staines should all be made together, but that the work should be advanced by five separate stages at an interval of years, in accordance with the increased demand, we may perhaps accept the Southwark and Vauxhall scheme as embodying one of the earlier stages of a complete scheme of supply.

Mr. Hodgetts mentions, among other sins which he charges against the lesser project, that it will retard the introduction of "a uniform municipal system." This is just such an argument as might proceed from Spring Gardens, but is by no means an essential part of the water question. Mr. Hodgetts also talks of a "Water "Trust;" and he describes the Southwark and Vauxhall as an "obstructionist Company," guilty of causing the failure of Mr. Cross's purchase scheme in days gone by. But if the Company succeed in getting their Bill passed, that will not prevent any other Company from making reservoirs at Staines, if they choose to do so, and can get capital for the purpose. Reservoirs at Staines have no especial merit over reservoirs at Sunbury, except that the site may admit of larger works. But the greater the distance the water has to be transmitted, so much greater must be the cost of the undertaking; and when there is a talk of spending ten millions, the County Council may contend that a few millions more will bring water from Wales. The situation is a critical one; and we rather fear such influence as Mr. Hodgetts may exercise is not calculated to be of public service in existing circumstances.

At the meeting of the County Council to-day, the Parliamentary Committee will present a report recommending that steps be taken to support the Council's Water Bill before the Standing Orders Committee. It may therefore be expected that the Council will endeavour to proceed with their Bill. Another Committee recommends that the Thames Conservancy Bill be opposed, partly for the reason that the Bill proposes to legalize the agreements made between the Water Companies and the Thames Conservancy in 1886. The report declares that "every "attempt to permit, directly or indirectly, further quan- "tities of water to be drawn from the river by the Water "Companies ought to be opposed." With respect to the Council's Water Bill, the Association of Municipal Corporations, meeting at the Guildhall on Saturday, passed a resolution objecting to "the general roving power" sought by that measure, as calculated to imperil the water supply of provincial towns.

The Right Hon. H. H. Fowler, the late President of the Local Government Board and the new Secretary of State for India, is interested in both gas and water supply, being a Director of the Wolverhampton Gas Company and the Kent Water Company.

The Managership of the Quaker's Yard Gas Company.—The position of Secretary and Manager of the Quaker's Yard Gas Company, Cardiff, for which applications were invited in the JOURNAL a few weeks since, has been filled by the appointment of Mr. Tom Wigglesworth, of Drighlington. The successful applicant has been for upwards of five years a pupil of Mr. A. F. Goodson, Engineer and Manager of the Heckmondwike Gas-Works, and formerly Secretary and Manager of the Drighlington Gas Company.

The Production of Gas from Paraffin Oils.—At the monthly meeting of the Scottish Section of the Society of Chemical Industry in Glasgow on Tuesday last, a paper prepared by Mr. J. F. Tocher, F.C.S., of Peterhead, on the "The Production of Gas from Paraffin Oils and from Pure Members of the Paraffin and Terpene Series of Hydrocarbons," was read, in the unavoidable absence of the author through illness, by the Secretary (Mr. Stanley Muir). Some of our readers will probably remember that Mr. Tocher assisted in the preparation of, and took part in the discussion on, Mr. J. Mackay's paper on "Enriching Coal Gas by Paraffin Oil or Liquid Hydrocarbons," at the meeting of the North British Association of Gas Managers in 1892. He was therefore in a good position to deal further with the subject. In his communication, which will be noticed at greater length in a subsequent issue, he pointed out that the access of interest which has lately taken place in the production of gas from oil is due to the employment of this gas as a valuable enricher of ordinary coal gas. The author described at length the various forms of retorts, &c., used by investigators, with the object of deciding on the most suitable formula—viz., that which will give a maximum of gas and a minimum of tar from the oil operated on. The varied results arrived at, both in his own and others' experiments, were set out in tabulated form; and the paper was further illustrated by diagrams of some portion of the apparatus experimented with. Very minute examination was made of the varying results obtained from subjecting solid paraffins, turpentine oils, olefines, and mineral oil of different gravities, to temperatures ranging from 500° to 1200° C.; and the general deduction arrived at was that the heavy mineral oils for gas making were superior to Russian petroleum—this, in its turn, being preferable to American petroleum. Mr. Tocher acknowledged the valuable aid he had received in his experiments from the courtesy of Mr. Mackay, formerly Manager of the Peterhead Gas-Works. It was decided to defer discussion of the paper; and Mr. Tocher was thanked for preparing, and Mr. Muir for reading it.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 498.)

THE course of business during the past week in the Stock Markets has been rather barren of any salient feature; and on the balance at the week's end there is not any considerable movement perceptible. In some of the odd things which are categoried in the Miscellaneous Market, there has been brisk speculation; but, taking the whole Exchange generally, business has been quiet. No one class has had a uniformly good time, except the choicest securities, for which there seems to be a never-failing demand. Among the rest, however, the Home Railways have had about the best of it; but others fluctuated. Silver—the key of the position for many—has been worked up and down again; and they have had to dance to the silver tune. Money has been in very good demand for short loans; discount rates promise to continue easy. The Gas Market has been active, especially during the earlier part of the week; and business throughout the entire list was very favourable—gas undertakings in almost every part showing an advance in value. Several quotations have made considerable improvement, and none have changed for the worse. Among the Metropolitan Companies, Gaslights were extremely brisk. The "A" opened at an immediate advance, and on Thursday touched 238, though the last transactions were not quite so good. There was plenty done in the secured issues, and they changed hands at nice prices; but the only advance in quotation was in the "H" 7 per cent. South Metropolitans were firm; and the "A" was in special demand—one or two lots being done at 316. Commercials steadily pushed on with the rest; and each issue scored a point in advance. Business marked in the Suburban and Provincial undertakings showed consistent firmness in all; and Brentfords and Bristol are now quoted dearer. Among the Continentals, transactions scarcely went outside Imperial, which was very brisk at the opening, and closed with a gain of one point on the week. None of the rest presented any variation. Water was not particularly active; but it gave proof of a better tendency, though the only change was an improvement in New River.

The daily operations were: Gas was lively on the opening day; Imperial Continental meeting with most attention. Gaslight "A" rose 1. On Tuesday, there was widespread advance. South Metropolitan gained 4; Gaslight "A," 3; Brentfords, 2 each; Commercials, 1 each; and Imperial Continental, 1. Wednesday's transactions were marked at good figures all round; but quotations did not move. Thursday was quieter, but very strong. Gaslight "H" rose 1½; and Bristol, 2. Friday was a quiet, firm day; a good proportion of business being done in Gaslight secured issues, at top or nearly top figures. New River rose 2. Saturday was firm all round; but nothing moved, except South Metropolitan "A," which advanced 1 more.

ELECTRIC LIGHTING MEMORANDA.

Electric Light from Liverpool Refuse—Secrets of the Wiring Trade—Dividends of Electric Lighting Companies—Professor W. Crookes on the Problem of Rating.

Now that the proposal to generate electricity for lighting purposes by means of the heat developed in the working of town refuse destructors is being very generally discussed, some interest attaches to the adoption of a little scheme of this kind by the Liverpool Corporation. When it is known that the capital expenditure upon this experiment is not intended to exceed £260, it will be understood that it is only a small thing; but it is also easy to understand how the idea of obtaining electric light from refuse, on ever so small a scale, appeals to the popular imagination. Moreover, it must be admitted that the little scheme has been very nicely worked out by the City Engineer (Mr. H. P. Boulnois), under the direction of the Health Committee of the Corporation; and it is the style in which a piece of engineering is done, rather than the size of it, that renders the matter interesting to members of the profession. All we hope in regard to this experiment is that the Liverpool people will be candid in giving the results, when the job has been completed long enough to prove itself. The reason for the necessary outlay upon the scheme being so small is that the destructor plant already includes an engine and boiler; so that only the dynamo, lamps, and connections have to be bought. The idea is to light the destructor yard and the buildings in connection with it, which are now lit by gas at an average charge of £125 per annum, by means of six 10-ampère arc lamps and 20 incandescent lamps. The present engine, which during the day drives a mortar-mill, is to do the work of lighting after dark; and it is estimated that the running expenses, including an allowance of £30 for maintenance, interest, and sinking fund, will be £88 per annum. We shall see how experience justifies the forecast. Mortar-mill engines have not, as a rule, done very well for electric lighting; and it is not clear what is to happen during the dark days of winter, when mortar and light may be required to be ground out simultaneously. It will probably be well to leave the gas-fittings in their places for awhile.

The recent exposure of the manner in which electric light wiring is too often done on board ship has caused a wholesome commotion among "the trade," and will, it may be hoped, do good in checking the growth of the "jerry" system of wiring both afloat and ashore. A curious contribution to the voluminous correspondence on the subject which has flooded the electrical journals comes from a man who subscribes himself "General Secretary, Electrical Trades Union." The letter is a bitter complaint against the grinding down to which the men who follow the ill-defined trade of working electrician are subjected by electric lighting contractors. It cites an instance—name, of course, withheld—of what is described as a "60-light job," where the foreman is paid 5½d. per hour, two men under him 6d. per hour, and five boys, "all of whom have paid a premium," are presumably not paid anything. We have nothing to do with the internal economy of the electrical wiring trade; but the statement just given is one to be commended to the careful attention of parents and guardians to whom are addressed advertisements, inviting premium pupils to learn "electrical engineering," to be found in the daily newspapers. The expediency of paying a heavy premium and maintaining a lad for years in order that he may be qualified in the end to earn "the dockers' tanner" is not particularly apparent.

Several electric lighting companies in town and country have managed to get together profit balances large enough to enable the Directors to recommend 5 per cent. dividends, which figure seems to be as high as is expected in regard to the central station lighting business. The Chairman of one of these undertakings has said, with reference to this rate of dividend, that it is not exorbitant, and consequently that the charge for current from which it was derived could not be exorbitant either. There is a little confusion of ideas here; for it by no means follows that low dividends are the result of doing a low-priced trade. Indeed, the contrary is more frequently the case, as the slightest consideration of the facts of commercial enterprise will suffice to show. The circumstance that central station companies cannot see their way to more than a 5 per cent. dividend under the most favourable conditions, while the majority of such concerns are far from having attained to such a standard of prosperity, shows, at any rate, that the prospect of the public being supplied with current at any notable reduction upon the existing rates is very dim.

Speaking at the recent annual general meeting of shareholders of the Notting Hill District Electric Lighting Company, Professor W. Crookes, the Chairman, who is always interesting, even when he fails to convince, said several things worth noting. The whole tenor of his address showed that the undertaking is settling down to its work, and that the Directors are fully alive to the necessity of cutting the coat according to the cloth. They are drawing near to that era in their career when, with a closed capital account, and every working expense duly charged to revenue, it will be proved whether electric lighting in this respectable suburban district is worth doing at the price. The average lamp earnings for the year are down to 6s. 6d., which is a very different figure from those suggested by the fancy of electricians who draw up encouraging estimates for municipalities contemplating electric lighting ventures. It must be conceded that electric lighting cannot be called dear at an average of 6s. 6d. per 8-candle power lamp. This is even less than the shilling per candle power per year upon which, before the introduction of meters, certain companies built up their connection. Upon the well-worn subject of rating, Professor Crookes actually contrived to offer a novel suggestion; and this is one of the most remarkable proofs of originality of mind ever given by the inventor of the radiometer. He observed that "householders live in houses where the rent is one-tenth of their income, and on the same basis the total rateable value of the buildings and machinery, &c., of the Company should not be fixed at more than one-tenth of its gross income." This is a new way of arriving at a correct assessment; the gravest objection to it being that the assessment authorities are not permitted to do business upon any such simple rule. Even as Professor Crookes put it, the anology is not quite perfect, for a householder does not pay one-tenth of his income in rates, but only pays on a proportion of the portion of his expenditure which he is content to allocate for rent. It is probably true of many householders that house-rent does represent nearly one-tenth of their income; but even so the observation is no more a law to be relied upon than are many other deductions from the civilized practices of humanity that have been made to stand for laws of the science of Political Economy—sometimes to the discredit of the science.

Alderman John Readhead, J.P., one of the Directors of the South Shields Gas Company, died at his residence at Westoe, last Friday, in his 75th year.

Death of Mr. R. C. Reid, of Edinburgh.—We regret to record the death, on the 4th inst., at the early age of 48, of Mr. Robert Carstairs Reid, M.Inst.C.E., of the firm of Messrs. J. and A. Leslie and Reid, the Engineers to the Edinburgh and District Water Trustees. It was only last December (as noticed in the JOURNAL at the time) that the head of the firm—Mr. A. Leslie—was removed by death; and his sole partner has survived him but three months. Some particulars in regard to Mr. Reid's work will be found in our Scotch Correspondent's "Notes."

A VEXED QUESTION.

If any additional argument were required to persuade those who conduct the great State-regulated industries of the United Kingdom of the expediency of following with closest attention contemporary developments of the theory and practice of valuing established undertakings of the kind that occupy the borderland between private and public enterprise, the still pending proceedings in regard to the acquisition of tramways by the London County Council would amply supply it. And when the source of the existing differences between the two parties to the transaction referred to, and of all others which the ultimate decision in this case will affect, is duly investigated, it will be found to be nothing else than the well-known *crux* to which the name of "Betterment" has been applied, for want of a more comprehensive and expressive term. It is essentially a raising in concrete form of the question as to whom appertains the floating asset of a property which, in its simplest form, is the "goodwill" of a mercantile concern. There has been an enormous amount of discussion upon this subject of late, chiefly started by the crudities vented in this regard by modern socialistic demagogues; yet the community seems to get no nearer to a general agreement respecting the principle sought to be covered by the term Betterment. Consequently, all direct contributions designed to facilitate our arrival at such agreement are to be welcomed; and so we are glad to get the further publication dealing with the general subject which Mr. Arthur Baumann, formerly Member for Peckham, has just produced.* Mr. Baumann has already written a book bearing the title "Betterment;" but as he now says, a great deal has happened since this volume appeared.

The author refers to the evidence taken by the Hybrid Committee, and to the debates in the House of Lords, and the correspondence in *The Times* as having defined the points of difference between the parties to this controversy, and thus brought the controversialists to closer quarters. He has therefore judged it advisable to entirely re-write his book, with the object of incorporating in it whatever extended knowledge these discussions may have brought to light. Unfortunately, as Mr. Baumann remarks, a dispute has arisen between the two Houses of Parliament as to whether the taxing of Betterment, as an element of the value of property, should be dealt with by Private or Public Bill. As he puts it, the question is "whether a change in the law of local taxation should not be preceded by some enunciation by the Legislature of the general principles on which it shall be based." It would appear on the face of it that there could be only one answer to such a query; but, unhappily, "a certain party in the House of Commons and the London County Council have deliberately selected Betterment as a good fighting question on which to have it out with the House of Lords." This is not the proper way to treat a complicated problem of local taxation; and Mr. Baumann very sensibly declines to follow it. How necessary it is to treat the question as a matter of principle might have been shown by the author by citing the inconsistent manner in which the London County Council are treating the Tower Bridge approach scheme and the tramway companies whose property they seek to acquire. They refuse to proceed with the approaches to the Tower Bridge on the southern side, because the House of Lords has refused to allow the precedent of taxing Betterment to be dragged into the Private Act required to authorize this work; and, on the other hand, they refuse to give the tramway companies anything for that portion of their property which is only Betterment in another shape. There could not be an apter illustration of the necessity for settling the principle before proceeding to the treatment of specific examples.

Mr. Baumann begins his task with an attempt to define what Betterment is. This is not an easy thing to do. He brings forward a quotation from an English classic to show that "betterment" means in a certain connection "superiority;" but without waiting to establish the meaning of the word in the sense in which he means to employ it throughout his book, he declares of "the thing" that "it is an immigrant from America, whose aims are pedatory, and whose methods are vague, uncertain, and undefined." We venture to object that this is hasty on the part of the author, who should first have explained what "the thing" is before proceeding to denounce it. As a matter of common knowledge, we do know what Betterment means; but it is always rash in a writer of books to presume upon the existence of common knowledge of this kind. Writers in newspapers and periodicals may do so, because their observations are essentially of passing interest. When a journalist writes upon a subject, it is because his readers are already interested in, and therefore know something about, it—at any rate, to an extent which warrants him in starting without definitions of terms. The popular meaning of terms is apt to change, however, from time to time, and so to leave text-books far behind. Hence a writer of any treatise upon a controversial matter which is meant to possess permanent value should be careful to put upon record the exact sense attached by him to the terms he uses to signify the subjects of controversy.

This is no pedantry, for Mr. Baumann expressly states that

* "Betterment, Worsement, and Recoupment. With a Note on Betterment in America." By Arthur A. Baumann, B.A. London: Edward Stanford; 1894.

"the thing," Betterment, is of American origin. It may be none the worse for that, since many good things come from America. In regard to language, however, one cannot be too careful in presuming to understand what Americans mean by the words they use; for it is a truth as indubitable as melancholy, that American writers, especially journalists, are cursed with a preverse spirit which drives them to degrade the language they employ to the lowest depths open to slovenliness, flippancy, and irreverence. Take this very term Betterment for example. We may think, in the pride of our common knowledge, that we know what it means; and that it signifies, when used in the political or economical sense for which alone it is needed, the enhancement of the value of a property, business, or hereditament as the effect of some beneficial influence, as a public improvement, for which the community and not the proprietor pays. If the word was first used in this sense in America, the journalists of that free country have long since emancipated themselves from such a limitation. In the journals connected with the American gas industry, it is frequently to be found employed to mean simply an improvement or extension of plant. Why an American writer should go out of his way to use the word which has the more limited original signification, instead of that which is more comprehensive and at the same time elegant, is a mystery of the same order as that in connection with the American fancy for the French word "exposition" in preference to the older, more natural, and more expressive English word "exhibition." The fact remains, however; and it is for writers like Mr. Baumann to make their account with it.

Candidly speaking, it would have been preferable if Mr. Baumaun had opened up and carried on his work with less bias against the London County Council, and had taken a wider view of the subject, which is not to be disposed of by sneering at the supposed prejudices of one particular Local Authority. Call it a phrase or anything else, there can be no disputing the fact that the central idea of Betterment, or the Unearned Increment has, to a certain extent, "caught on," in the estimation of a not inconsiderable party of that populace to whom, for good or for evil, supreme power has been entrusted. What sound publicists have to do in this emergency, if the term may be used, is to dispassionately survey the origin of the novel idea, and test its foundations and possible consequences. Our own idea is, and always has been, that all increase of value of properties and hereditaments is, as a matter of fact, fully accounted for to the community under the head of either income-tax or local rating. Whether this account is properly taken, may be matter for argument; but nobody knowing the facts would say that The Gaslight and Coke Company, for instance, do not pay in full all that can be charged upon their undertaking in respect of their place among the rateable hereditaments in the Metropolitan area. Moreover, the difficulty of assessing a charge for Betterment or the Unearned Increment is of the same nature as that which has been accepted in law as barring claims for consequential damage. It may be quite true, as the nursery jingle has it, that "for want of a nail the shoe was lost," and that this loss eventuated in the loss of a Kingdom; but no action for damages to whoever lost the Kingdom would lie against the farrier who shod the horse, even if it could be proved that he did his work negligently. There must be a limit to claims of this kind. It is of the nature of a public improvement to be made for the public benefit, which is the sole valid reason for it. The improvement of a town may or may not carry with it specific benefit to certain owners of property. If it does, then the increased rates show it. As Mr. Baumann rightly says: "The proposition that properties specially benefited by a public improvement should be specially assessed, cannot be denied, and cannot be the principle of Betterment, for it is already part of the existing law." The author arrives at the conclusion that "Betterment is a proposal to make a man whose interest in a property will . . be increased in value at some future time by a public improvement, contribute to that improvement before the time has arrived, and in addition to the contribution he has been or may be called on to make under the rating law."

Having thus arrived at the opinion that Betterment is "a present and perpetual tax for a future and prospective benefit," Mr. Baumann has no difficulty in marshalling a long array of objections to it—first, because it is taxation of capital value; secondly, because it cannot be equal and uniform; thirdly, because it must be uncertain and arbitrary; fourthly, because it will be very inconvenient; fifthly, because it will be costly to collect; furthermore, because of a variety of practical difficulties, the nature of which must be sought for in the book itself. These lead up to the consideration of Worsement, which, of course, is the opposite of Betterment, whatever this may be, and has quite as real an existence. There is never a town improvement carried out but some individuals suffer for it. There is no intention on the part of anybody to offer compensation out of the public funds for this damage; yet everybody admits that such a course would be just. For further light upon this part of the subject, reference should be made to Mr. C. A. Cripps's book on the "Law of Compensation."

The last chapter Mr. Baumann devotes to the consideration of Recoupment. This principle has been legalized by the Act of 1877 under which the Metropolitan Board of Works carried out certain street improvements. As the author says: "After much discussion, and a joint conference of both Houses, it was decided to give the Board of Works power to buy more land than was actually required for the construction of the new streets, in order that, by reselling the surplus lands at their enhanced value, the net cost to the ratepayers might be reduced." It is an illustration of the dangers attaching to the practical carrying out of such principles that it was the jobbery which attended the operations sanctioned by this Act that brought the Metropolitan Board of Works to its inglorious end. Mr. Baumann is fully aware of this circumstance, which he is careful to mention; but he nevertheless commends the principle of Recoupment as the fairest and most businesslike method of dealing with town improvements. The book concludes with a "Note" on Betterment in America, which includes a letter of a very eminent American jurist—Mr. F. J. Stimson. This letter ought to be read, and its drift committed to heart, by those among ourselves who are inclined to worship the "democracy," and to incline to the "Progressive" doctrine that the height of public virtue is to be found among the people who are lowest in everything else. We are able to recommend Mr. Baumann's book all the more heartily on account of the two or three pregnant pages which Mr. Stimson contributes to it.

NOTES.

The Explosion of Gaseous Mixtures.

At a recent meeting of the Yorkshire College Engineering Society, Mr. Firth submitted a short contribution on the subject of gas explosions, with particular reference to the proportions of gas and air necessary to form explosive mixtures, and the influence of pressure on the temperatures of ignition. The experiments which furnished the results communicated by Mr. Firth were carried out in a cast-iron vessel of about one cubic foot capacity—ignition being effected by an electric spark. The time occupied in obtaining the maximum pressure was registered upon the drum of a Crosby indicator, in which the drum was caused to revolve at a known rate of speed in one direction. No poorer mixture than 4 volumes of air to 1 volume of coal gas could be exploded when uncompressed; whereas with compression, mixtures up to 17 of air and 1 of gas, after diffusion, could be fired by the spark. By compressing the mixture to 15 lbs. per square inch, a 4 to 1 mixture could be exploded; but at the same pressure nothing weaker than 13 to 1 could be fired. The pressures obtained in this way were lower than those that have been recorded under similar conditions by earlier experimenters. It does not appear from the report that the coal gas used by Mr. Firth was analyzed or tested in any way; nor is it stated where the experiments were carried on. But if, as is probable, the work was done with Leeds gas, this may be taken as of about 18-candle illuminating power at ordinary times.

Boiler-Feed Purification.

It is often remarked that the capabilities of the most familiar industrial appliance or process for improvements are not exhausted; and a striking illustration in support of the observation is supplied by Lyons's apparatus for purifying boiler feed-water. It might be thought that if any field of mechanical engineering activity could be truthfully described as overcrowded, it would be that of feed-water treatment; yet, in this very regard, Mr. Lyons has succeeded in introducing an apparatus which recommends itself at first sight as an ingeniously simple means of overcoming a familiar trouble. It depends upon the well-known principle that salts of lime, magnesia, &c., present in water are thrown down when the water is heated. Hence the variety of appliances in use for purifying feed-water by warming it, on its passage to the boiler, in some vessel in which the precipitated scale-forming matters are caught and prevented from entering the boiler. Mr. Lyons's apparatus is the simplest device yet hit upon for effecting this object. It consists of a copper basin so placed inside the boiler, with its brim above the water-line, that it will catch the feed-water upon entering, which it is made to do in the form of spray, by means of an atomizing valve. The idea is that the water will drop its sediment in this basin, and that the overflow from it which runs into the boiler will be clear. The basin is connected by a tube from the bottom with a blow-off cock, so that the accumulated impurities can be blown out from time to time. The makers state that this apparatus has been working in their boiler since March last, and has kept it clean and more free from scale than it has ever been before. The appliance would, however, appear to be useful only with a cold feed.

Violle on the Electric Arc as a Standard of Light.

M. Violle has communicated to the *Journal de Physique* some observations upon the light of the carbon arc, which tend to show that this physicist is not disinclined to abandon his platinum standard of light, which a complimentary Congress of Electricians were over-hasty in formally adopting as the international unit. The paper is descriptive of a form of electric furnace devised by the author; and it deals with the light given out by, and the temperature of, the electric arc between carbon points. It is considered to be experimentally proved by this apparatus that the electric arc is the seat of a perfectly definite physical phenomenon—namely, the ebullition of carbon; for the carbon arc is characterized by a constant brightness. That is to

say, the amount of light given out by a definite area of the positive crater is a constant quantity, while the temperature is always the same. Moreover, all the circumstances which attend normal ebullition are here present, and remain identical. It is admitted that the constancy of the character of the light radiated from the carbon arc has been noticed by Abney and Festing, who have suggested its adoption as the standard of white light, and have actually so employed it in connection with certain researches of their own; and M. Violle's observations show that the brightness of the arc is unaffected by the number of watts consumed by the lamp. This he has proved by direct comparison of the arc with a standard light, and also by photographing the positive carbon, when the density of the image remained constant.

Distributed Refrigeration.

An interesting account of the arrangements whereby artificial refrigeration is distributed in the town of Denver, Colorado, by street pipe-lines was lately given to the Franklin Institute by Mr. David Branson; and the paper opens out the prospect of a new industry for large tropical centres of population. The industry as carried out in Denver is described as that of "distributing power to produce cold." The popular idea is that the Company furnish cold air; but, as a matter of fact, no cold air, or anything else cold, is sent through the pipes. Correctly speaking, the business in question does not depend upon the supply of anything, but rather consists in the removal from subscribers' premises of two things of which they desire to be rid—heat and humidity. This is done by the agency of ammonia, according to a system devised by Messrs. Starr, Thornbrugh, and Branson. The plant in Denver has been working continuously for four years, and so successfully that the patrons of it say they would not return to the use of natural ice if they could get it for nothing. In the brewing, meat-packing, dairy, and cold storeage warehouse industries, the refrigerating machine saves immense sums annually; and it was the object of the Denver scheme to secure to the smaller consumer the benefits, and to the vendors the profits, of mechanical refrigeration. The system of distribution is a vacuum one; and the degrees of cooling in every locality connected with the system are automatically regulated according to the requirements of the customers. The limit of practical working distance is stated to be about the same as with illuminating gas; but it is immaterial whether the plant is on low or high ground, or whether the pipes run up or down hill. The expense to consumers is about 20 per cent. less than would be paid for ice sufficient to furnish an equivalent amount of cooling.

The City Engineership of Worcester.—At the meeting of the Worcester City Council on Tuesday last, Mr. Thomas Caink, Assoc.M.Inst.C.E., the Assistant-Surveyor, was appointed City Engineer and Surveyor, in succession to the late Mr. S. G. Purchas, whose death was announced in our columns a few weeks since. The new Engineer is a native of the city, which he left to take the position of Assistant-Surveyor and Gas and Water Works Manager at Malvern. He was subsequently Surveyor and Gas and Water Works Manager at Teignmouth, whence he returned to Worcester as assistant to Mr. Purchas. This appointment he held for about eight years. Some time ago, Mr. Caink took out a patent for a station and district governor for automatically regulating the pressure of gas to varied consumption, for which he was awarded a prize medal at the Inventions Exhibition of 1885. He has recently patented a new system of sewer ventilation, and an improved form of reservoir gauge for recording at any distance the height of water in reservoirs. At the same meeting, the Council recorded their appreciation of Mr. Purchas's long and faithful services to the city, by passing a vote of condolence with his family in their bereavement.

The Transactions of the Societe Technique du Gaz en France.—We have received the volume of Transactions of the Société Technique du Gaz en France for the past year. It comprise the report of the proceedings at the twentieth congress, held in Paris in June last, with the full text of the papers presented, the remarks thereon, and the list of officers and members, &c. In an appendix is given a long and interesting contribution to the literature of the gas industry, prepared, at the suggestion of the Committee of the Society, by a Committee composed of the last three Presidents (MM. Cornuault, Salanson, and Melon), consisting of a review of the improvements effected since the year 1889 in the various appliances employed in the utilization of gas. The section devoted to lighting is by M. Cornuault; that on heating, by M. Melon; and that on motive power, by M. Salanson. The appendix also contains several other papers. As on previous occasions, M. Victor Delahaye contributes to the volume a review of the most notable legal cases affecting the gas industry; his record being now brought down to the end of 1892. The technical matter is illustrated by several engravings in the text, as well as by eleven folding plates. Accompanying the volume is an index, in pamphlet form, to the whole of the Transactions. It is arranged, first, in chronological order; secondly, under the various subjects; and, thirdly, under the authors' names alphabetically arranged. The work done by the Society is well shown by this index; for whereas at the first meeting, in 1874, there were only three communications, last year the number was increased tenfold.

TECHNICAL RECORD.

THE CHEMICAL TECHNOLOGY OF COAL GAS.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

[A Course of Lectures delivered at the Stratford Town Hall.]

VII.—*The Testing of Gas.*

When light is emitted from a luminous point, it radiates in all directions; and as the light travels farther and farther from the source, so it becomes more and more enfeebled, and the amount of light which illuminates any object placed in the path of the rays becomes less. This is due to two factors—first, to the spreading out of the light-rays to fill the increased space; and, secondly, to the absorption and dispersion of the light by the air through which it passes containing solid particles and vapours. In the ordinary methods adopted for the measurement of light, this second cause is not taken into account, as it is supposed to affect both the standard of light and the light which is being determined—if not to an equal extent, at least in such a way as to make any error due to it sufficiently small to be disregarded.

The effect which distance from the source of light has upon its intensity may be found by taking a piece of cardboard one square inch in area, and fixing it exactly one foot away from a bright light. If now a screen be placed 2 feet from the light, and behind the piece of card, the shadow thrown by the card will be 4 square inches; at 3 feet, 9 square inches; at 4 feet, 16 square inches, and so on. If we take a screen with an aperture of one square inch cut in it, we find that the surface illuminated at 2, 3, and 4 feet from the screen is 4, 9, and 16 square inches respectively. From this we are forced to the conclusion that the amount of illumination is inversely as the square of the distance from the flame. If now the light from a candle illuminates a screen one foot distant from it to the same extent as a gas-flame 4 feet distant, we should conclude that the gas-flame emitted 16 times as much light as the candle-flame.

Attempts began to be made as early as 1700 to measure the illuminating value of flames by trying how many pieces of glass had to be placed in the path of the rays in order to entirely cut them off—a method originally due to François Marie, although the idea has been revived within the last twenty years. A great step was made in 1760 by Bouguer, who proposed to use a candle as a standard, and to employ screens of tissue paper as indicators—in this way laying the foundation of our modern methods of photometry, by introducing a standard of light, which, although abused by everyone, has not yet been replaced by anything else. Bouguer arranged his standard and the light to be tested behind a transparent screen in such a way that one half of the screen received the light from the candle, and the other half the light which was being tested; and he compared the illuminating values by measuring the distances at which the light had to be placed from the screen to obtain equal illumination of the two sides. This arrangement has several times been copied by other experimentalists; and the arrangement of the screen in Mr. Vernon Harcourt's table photometer is of somewhat the same kind. In 1792, Count Rumford devised his shadow photometer, in which two shadows of the same upright rod are thrown upon a white screen by the standard and the light to be tested; and the lights having been arranged so that the shadows are of equal intensity, the squares of the distances of the two lights from the rod will give the relative illuminating values.

Many other methods of comparing the relative value of flames were proposed; and, in 1843, Bunsen introduced the idea of using a piece of paper with a grease spot in the centre of it. If a piece of paper be greased, the greased portion is more translucent to light than the part unacted upon, and therefore, if a light be placed on one side of such a piece of paper, the grease spot shows out as a bright spot on a darker ground. If the second source of light be then placed on the opposite side of the piece of paper, the grease spot will appear bright on the side opposite to that on which the strongest light is placed; and if the lights are so arranged that each side of the paper is equally illuminated, the grease spot will practically disappear. This method of measuring the intensity of light is the one most used at the present time; the only difference being that the so-called Bunsen disc now consists of a small circle of ungreased paper in the centre of a greased disc. The discs are made by fixing them on a thin steel axis, which is made to rotate at a high rate of speed. As they rotate, a vessel containing wax dissolved in some volatile liquid is brought into contact with them; and as they rotate with the paper submerged to a suitable depth in the liquid, the unimmersed portion remains as a perfect circle immediately around the small axis. After removing the excess of the solution, and allowing the solvent to evaporate off, the discs are removed from the spindle, and are then ready for use. Another form of disc which is also to a certain extent employed is known as the Leeson or star disc, in which two thin sheets of paper are fixed on either side of another thicker piece of paper, out of which a star-shaped piece has been cut. With the original form, this gave some trouble on account of the thin paper warping and presenting an uneven surface; but Mr. Dibdin has introduced a modified form in which the three layers of paper are fixed together with very thin starch water, and are then dried under pressure—this treatment doing away

with the cockling which was the trouble in the former case. With the Bunsen disc, the great drawback is that when we have two lights of different colours, it is very difficult to judge the moment of equal illumination; while the Leeson disc to a great extent does away with this, and allows of the comparison of lights of different tint with much greater ease.

It is often found, even with discs of the best construction, that the two sides give somewhat different readings, with the result that a serious error may easily be introduced. It is necessary, therefore, after taking a few readings of the illuminating power, that the disc should be reversed, and a second set of readings taken; and by adopting the mean of these, any serious error is eliminated. If, however, a disc is found to give very different results on reversing, it is better to at once discard the disc; and as the greased surface has the power of fixing dirt, it should be carefully protected from dust when not in use, and a new disc should be taken directly the old one shows any discoloration or discrepancy in working.

As soon as the Bunsen disc came to be used for accurately measuring the illuminating value of different sources of light, various forms of photometers began to be introduced. The instrument first consisted of an open bar, 100 inches in length, with the Bunsen disc fixed on a frame, which rolled on the bar, and could be moved backwards and forwards. At one end of this the standard burner was arranged; and at the other end, the candle which was to be used as a unit of light. This was afterwards improved by Dr. Letheby, who fitted the disc in a small box open at each end to the two sources of light, and sliding as before upon the bar. In the front of the box was an opening through which the observer looked, and across which, at right angles, came the edge of the disc. This sighting-box was fitted with two small mirrors at such an angle that the reflection of the two sides of the disc could be simultaneously seen by the observer standing in front of the box. A still greater improvement was also made by replacing the one candle-flame by two flames emitted by two halves of the same candle. The candles used for testing gas are mould candles, and are therefore slightly taper, in order to admit of their easy removal from the mould in which they are cast; and if one candle only be employed, the quantity of sperm melted during its consumption will be continuously altering. The great improvement consists in cutting the candle in half, and lighting in the middle, so that while one half burns down to the thick end, the other burns down to the thinner end. These candles are arranged upon a small balance, so that the amount of sperm consumed during the period of testing can be accurately determined; and, under existing regulations, only those candles that burn more than 114 or less than 126 grains of sperm per hour are considered to comply with the term "standard candles." Dr. Letheby also reduced the length of the bar from 100 to 60 inches. This may or may not be an advantage, according to the state of the atmosphere. On the open 100-inch bar, the travel of the disc for an alteration of illumination was considerably larger than on the 60-inch bar; and for this reason the 100-inch bar was an advantage. But if the atmosphere contains fog or any large quantities of suspended matter, it is manifest that the longer the bar, the greater will be the interference of the atmosphere with the amount of light falling upon the disc. If, however, the time should arrive when the standard and the light to be tested are of nearly the same value, this interference will disappear, and increase in accuracy will be obtained by returning to the 100-inch bar.

The type of photometer known as the "closed Evans" was introduced in 1858. It consists of a long box enclosing the candles and the light to be tested. The disc was fixed and the candles were mounted on their balance, which moved in a travelling holder attached to an endless cord working with a small winch. This photometer was designed for testing gas in the open air; and so every precaution was taken to prevent draughts to the gas and candles. For this purpose there is some definite reason for the construction; but its introduction afterwards for testing gas in rooms such as those provided in the gas-testing stations was a grave mistake, as the want of proper ventilation and the heating effect of the walls of the photometer upon the larger flame caused the results to be considerably in favour of the latter, and it can in no way be looked upon as a scientific instrument. This objection was to a great extent, however, overcome by improving the ventilation at the two ends at which the candles and the gas are burning, as is done in the "tower" photometer; but where a darkened room can be obtained, the open bar photometer is undoubtedly the best, as the smallest check to the free passage of the air to the flame causes slight increase of the products of combustion. This exercises a very great influence upon the amount of light emitted by the flame; and as the tendency is to act upon the smaller flame more than upon the larger, the results at once become most unreliable.

Ever since Bouguer introduced the candle as a standard of light, it has held its own, in spite of the extremely unsatisfactory results which are to be obtained from it; and it is useless to strive after scientific accuracy with the remaining parts of the apparatus while the standard itself is liable to such wide variations as to absolutely nullify the results obtained by its use. Up to 1850, no definition seemed to exist as to what the candles were to be that were used for gas testing. In that year, however, an Act was passed in which wax candles were prescribed for this purpose; and in 1860 the Metropolis Gas Act defined and prescribed sperm candles of six to the pound, each burning 120 grains per hour, in place of the wax candles previously used. These sperm candles emitted more light than the old wax candles—14 sperm candles being equal to 16 wax ones. It was found, however, impossible to use pure spermaceti; and in order to prevent crystallization of the spermaceti, from 4 to 5 per cent. of beeswax had to be mixed with it. Slight variations in the quality of the sperm and the method of admixture, and changes in the process of manufacture, will sometimes tend to slightly alter the results obtained with such candles. The weak point of the candle, however, which has led to endless trouble, and which renders it absolutely unfitted to be looked upon as a standard of light, when used according to the ordinary prescribed methods, is the wick—the roughness or smoothness of which, and its curvature during burning, causing extraordinary variations in the light emitted by it, even supposing that the wicks could be made absolutely uniform, the twist of the thread kept constant, and the same amount of strain placed upon them during the making of the candle.

It has been conclusively shown by Mr. W. C. Young that the standard sperm candle may be relied upon to give very uniform results, if due regard is paid to the condition and shape of the wick before commencing an experiment. But inasmuch as the method by which this desired end could be brought about is not in accordance with the instructions of the Gas Referees as to the mode of using the candle for testing gas, it is useless to discuss the question; and one can only agree with the various Committees who have considered the subject of standards of light, all of whom are unanimous in condemning the sperm candle as not being in any way reliable. In spite, however, of the torrent of abuse which during the past fourteen years has been showered upon the sperm candle and the numerous complications to which it has given rise, the difficulty of finding a standard which should be more reliable, and yet be as convenient to employ, has been so great that the candle still survives as the only legal unit of light, although many attempts have been made to replace it by something more satisfactory. Another reason for the survival of the candle is that the attempted improvements in the manufacture of sperm candles have in all probability resulted in their emitting a small fraction less light than was the case with those in use at the time of the passing of the Act; and the vested interests of the gas companies is so strong that they are able to successfully oppose any alteration of the standard which would in any way tell against them.

Attempts have from time to time been made by the Gas Referees to render the method of using the candles more accurate. In their earliest "Notification," some eight years after the sperm candle was legalized, they prescribed that "the candles are to be lighted at least ten minutes before the beginning of each experiment, so as to have arrived at their normal rate of burning, which is shown when the wick is slightly bent and the tip glowing." In 1877 this direction was altered so as to read: "The candles are to be lighted at least ten minutes before the beginning of each testing, so as to have attained their normal rate of burning;" and it was also ordered that all testings were to be rejected where the candles burnt more than 126 or less than 114 grains per hour. No further alteration took place until 1889, when, the Gas Referees' attention having been drawn to the great differences ascribed to the illuminating value of the gas by variations in the position of the wicks, the relative positions of the candles and wicks were for the first time defined; and it was also prescribed that the gas examiner should use a different candle for each test made. All this, however, has proved perfectly inadequate to make the candle into a satisfactory standard; and it yet remains to be seen if the minute directions as to the material and method of treatment of wicks and sperm which they have lately issued will result in any improvement. It will be interesting, therefore, to glance at some of the proposed substitutes which have been suggested.

In 1869, Mr. Keates introduced a lamp consuming sperm oil, which was practically a modified form of the "Moderator" lamp; and when burning sperm oil at the rate of 925 grains per hour with a 2-inch flame, it gave a light equal to 16 candles. This form of lamp (which was afterwards modified by Mr. W. Sugg, who placed in front of the flame what was practically a small Methven slot) was found to give results which, although more constant than those obtained from candles, were not sufficiently good to justify its general adoption. The Carcel lamp, which is the standard used in France, dates back to 1800. The oil used in this is refined colza, which is forced up to the wick by means of a small clockwork pump; and the oil burnt at the rate of 42 grammes per hour equals one Carcel, or 9·5 English candles. The amyl-acetate lamp, devised by Herr Hefner-Alteneck, is practically a spirit-lamp, burning the vapour of amyl-acetate. The wick is contained in a round tube of German silver 8 mm. in diameter and 25 mm. high. It is formed of a strand of cotton yarns, and is so regulated as to produce a flame of 40 mm. in height. Under these conditions, it is supposed to give a light equal to one candle; but in some experiments made by Mr. Dibdin, it was found that the height must be increased to 51 mm. in order to give a light agreeing with the Methven standard. The great drawback to it is the red colour of the flame, which renders it very difficult to compare the light emitted by it with any source approaching white light. Perhaps the most scientific and least

practical standard which has been proposed was that the unit of light should be that emitted by a square centimetre of platinum at the point of fusion, which was suggested by Professor Violle; but the insurmountable difficulties attending the use of such a standard would always prevent its adoption.

The most convenient standard of light, and the one most used for practical testing in gas-works, is the Methven screen, first introduced in 1878, which consists of an upright rectangular metallic plate fixed in front of a "London" Argand burner. An upright plate has a slot which is covered by a thin silver plate, having a vertical slot of such dimensions as to allow of the passage of as much light as equals that afforded by two average standard sperm candles when the Argand burner is provided with sufficient gas to give a flame 3 inches in height. It is manifest that, when used with coal gas, it is only within certain limits that one could rely upon a small portion cut out of the original flame emitting a practically constant light; and that, although these limits are well within the illuminating value of the London gas supply, it is still very advisable to obtain greater constancy in result, which is done by using an aperture of smaller area, and carburetting the coal gas in the burner with pentane.

Perhaps the most important of all the proposed standards was Mr. Vernon Harcourt's 1-candle pentane unit, first described by him at the meeting of the British Association for the Advancement of Science in 1877. The gas used for this standard is made by bringing together, in a gasholder, air and liquid pentane, which evaporates and mixes with the air, in the proportion of 1 cubic foot of air and 3 cubic inches of pentane. The pentane to be used is a mixture of pentane with some of the paraffins of lower and higher boiling-points, which is prepared by distilling the light petroleum at 60° C., at 55° C., and twice at 50° C. The pentane thus prepared must satisfy the following tests: On agitation with 1-20th of its bulk of fuming sulphuric acid for five minutes, it must impart to the acid only a faint brown colour. Its liquid density must be between 0·62 and 0·63 at 62° Fahr. The liquid must evaporate at the ordinary temperature absolutely without residue when the tension of its vapour is not less than 7·5 inches of mercury. The density of the vapour compared with air must not be less than 2·47, nor greater than 2·53.

The standard 1-candle pentane unit burner consists of a brass tube 4 inches in length and 1 inch in diameter, which the gas enters towards the bottom. The upper end of the tube is closed by a brass plug, half an inch in thickness, in the middle of which is a round hole, a quarter of an inch in diameter. Around the burner is placed a glass cylinder, 6 in. by 2 in., the top of which is level with the top of the burner—air entering through the gallery on which the chimney stands. Above the burner is supported, at a height of 62·5 mm., a piece of platinum wire about 0·6 mm. in diameter, and from 2 to 3 inches in length. The air gas passes through a small meter delivering at each revolution 1-60th of a cubic foot, and then through a small governor fitted to regulate the flow to half a cubic foot an hour. The height of the flame is adjusted by means of a delicate stopcock, until the top of the flame appears to touch, but not to pass, the horizontal platinum wire, which is adjusted so as to be exactly over the flame, and to extend not less than half an inch beyond it.

In practice, the great drawback to this unit is that it is very difficult to get two observers to adjust the height of the flame exactly alike, and also that it is very easily affected by draughts and by vibrations; and it also appears preferable to use a standard which shall be more nearly that of the light which is to be tested. To fulfil these conditions, Mr. Dibdin has proposed a 10-candle pentane Argand, burning fully pentanized gas or air. It consists of a specially constructed Argand burner, giving a slightly bellied flame, the top of which is cut off by a screen exposing a fixed height of flame; and this burner, from the constancy of the results obtained, the ease of manipulation, and the small extent to which it is affected by external causes, seems likely to take the place of candles should these unreliable standards ever be discarded.

The Harcourt screened lamp consists of a vessel, somewhat like an ordinary spirit-lamp, which contains the oil or liquid with which the wick is fed. This liquid is again pentane, derived from petroleum by repeated rectification. Fastened to the vessel containing the pentane is a tube, through which the wick is passed, and which is fitted with an ordinary double-spiked wheel turned with a handle for regulating its height. Another tube surrounds the wick-tube, and answers the purpose of keeping the latter cool, and also of steadying the current of air supplied to the flame. A metal chimney surrounds the burner and the lower part of the flame, and is connected with the upper chimney by curbed metal bands, sufficiently removed from the flame as not to affect it. Through the space thus left between the upper and lower chimneys, the central part of the long flame is alone visible; and the opening can be regulated so as to yield a light equal to ½, 1, or 1½ candles as desired. The lamp is in reality an improved amyl-acetate lamp, but burning pentane; and only a portion of the flame is taken for the standard.

In gas testing as at present practised, coal gas has always to be burnt at a fixed rate of flow—*i.e.*, 5 cubic feet per hour; and although this gives very good results when the gas happens to be within a short range of 16 candles in illuminating value, yet directly it falls below 15½ candles it acts very prejudicially on the illuminating value recorded. The "London" Argand and its glass, as regulated by the Act, supply an amount of air of the right quantity for supporting the combustion of a 3-inch flame; and directly the flame falls much below this in height, combustion is overdone, with consequent loss of illuminating power, while if the gas is much richer, the flame will be considerably longer, and the air supply will be insufficient for complete combustion, with the result again that a lower illuminating value is recorded. One of the greatest improvements that remain to be made in our system of testing gas is that the gas shall be burnt so as to produce a flame 3 inches in height, and the illuminating value ascertained from the quantity of gas necessary to give this result.

The gas supply in London is rigidly tested, not only as to its illuminating value, but also as to purity. In order to ascertain if the gas is free from sulphuretted hydrogen, 10 cubic feet of gas are made to pass slowly, at the rate of 0·5 cubic foot an hour, through an apparatus in which are suspended slips of blotting-paper impregnated with basic acetate of lead. The way in which this apparatus is arranged makes this test of the most delicate description, as the gas is passed out through small delivery-jets, and is made to impinge directly upon the test-paper, so that every particle of the gas comes in contact with it. The minutest trace will give rise to a slight discoloration; and if any whatever is found to have taken place, it is held to be conclusive proof of the presence of sulphuretted hydrogen in the gas. The blackening of lead paper under these conditions is due to the formation of lead sulphide; and when paper which has been so blackened is to be preserved as evidence, it is necessary to keep it out of contact with direct sunlight, as it is found that lead sulphide, especially in the presence of moisture and sunlight, oxidizes up to lead sulphate, which, being white in colour, causes the stain to disappear.

In London coal gas, containing as it does practically no trace of ammonia, there is little risk of the paper being stained with any substance other than sulphuretted hydrogen; but in a gas in which both ammonia and carbon disulphide exist, it is quite possible for lead thiocarbamide to be formed on the paper, which is immediately broken up into lead sulphide. I have made a number of experiments upon this action, and find it is necessary that there should be about 300 grains of each impurity present per 100 cubic feet of gas, in order to produce even a light stain upon the most sensitive paper in four hours. A 5-gallon (0·5 cubic foot) glass jar was filled with coal gas, to which carbon disulphide and ammonia were added in the proportion of 187 grains of carbon disulphide per 100 cubic feet and 4 grains of ammonia. There was no stain on the test-papers, even after standing for three months. Other experiments show clearly that the ammonia must equal the carbon disulphide in quantity for any action to take place; and that the quantity was so far in excess of anything likely to be found in the gas, that there is no practical chance of stains arising from this cause.

Having been proved to be free from sulphuretted hydrogen, the gas is passed through an apparatus consisting of a glass cylinder filled with beads, also of glass, which have been moistened with a known quantity of standard sulphuric acid. The dilute acid attracts and absorbs every trace of ammonia which may be present in the gas; and when the 10 cubic feet have all slowly passed through at the rate of 0·5 cubic foot an hour, the tube and beads are thoroughly washed out with the water. The standardized acid and wash-water is made up to a known volume, and is then titrated by standard ammonia (log-wood solution being usual as an indicator); and if the same amount of free acid is not found as was originally put into the tube, it is taken as a proof that some of it has been neutralized by ammonia present in the gas. The maximum amount of this impurity allowed is 4 grains per 100 cubic feet. If any quantity were allowed in the gas, it would be found to have a highly corrosive action upon brass gas-fittings, and would also give rise to reactions with the small quantity of carbon disulphide vapour present in the gas. A rough test for ammonia in coal gas is to allow the gas to impinge for some time upon a piece of test-paper coloured with turmeric solution, which assumes an orange-brown tint if ammonia is present.

The gas which has been tested for sulphuretted hydrogen and ammonia is next passed through a meter, the rate of flow to which is adjusted to 0·5 cubic foot an hour, and which automatically cuts off the gas when 10 cubic feet have passed. The gas is burnt in a small Bunsen burner with a steatite top, which is surrounded by a tray having a circular channel around its upper surface, into which fits the wider end of a glass trumpet-tube. The stand around the burner has placed upon it about 2 oz. of sesquicarbonate of ammonia; and as the flame burns, this gradually volatilizes, and supplies ammonia, which passes upwards through the trumpet-tube with the products of combustion. The trumpet-tube is connected with a vertical glass cylinder filled with glass marbles, through which the products of combustion pass. The water vapour from the flame condensing, takes up the ammonia gas; and this in turn "fixes" every trace of sulphur dioxide given off by the combustion of the gas from the sulphur compounds other than sulphuretted hydrogen. To the top of the cylinder is fixed a long glass tube, which increases the up-draught, affords an exit for such products of combustion as cannot be condensed, and also completes the condensation of the aqueous vapour.

At the bottom of the cylinder, a small glass tube is fixed in flush with the upper surface, and through it the liquid condensed in the cylinder drops into the beaker placed below. When the ammonia first takes up the sulphur dioxide in solution, ammonic sulphite is formed; but, under the conditions existing in the apparatus, the sulphite is at once oxidized to sulphate. Consequently, the water collected in the beaker contains ammonic sulphate; and the liquid having been made up to a known volume, the sulphate is determined by precipitation with baric chloride in the presence of hydrochloric acid, and is returned as grains of sulphur per 100 cubic feet of gas.

Under the London Gas Acts, the gas must not contain more than 17 grains of sulphur per 100 cubic feet in the summer, and 22 grains in the winter.

[The portion of the lecture dealing with photometric methods was illustrated by a very complete set of photometric apparatus, fitted up by Messrs. Alex. Wright and Co., of Westminster.]

DR. BUNTE ON CARBURETTING GAS.

The following is a slightly condensed translation of a paper on the above subject, communicated by Dr. H. Bunte, to the thirty-third annual meeting of the German Association of Gas and Water Engineers, at Dresden. The text of the paper was given in a recent number of the *Journal für Gasbeleuchtung*.

The communication made to the meeting of the Association at Kiel on the relative value of the different hydrocarbons in gas for the development of light,* may, in view of the immense importance of the question of carburetting at the present day, be advantageously followed by a more general review of the subject. In the present paper will be recorded the results of experiments carried out by myself and my pupils on (1) incidents of the formation of water gas, (2) the decomposition of illuminating gas at high temperatures, and (3) the behaviour of carburetted gas at low temperatures.

It may be argued that the question of carburetting is of minor importance in Germany, where large towns such as Berlin and Cologne, do not use enriched gas. But elsewhere it is otherwise, as Professor Hempel has shown with regard to America, where carburetted water gas forms two-thirds of the total production, owing to the cheapness of anthracite and petroleum. In England, again, different conditions prevail. There are no large deposits of anthracite suitable for making water gas, and no crude petroleum or other oils (leaving out of consideration the Scotch shale oils) suitable for enriching; but, on the other hand, there are rich gas coals, as well as cannel. Despite the presence of the latter, the question of carburetting has been discussed there recently with a vigour that proves its immense importance to the gas industry. Owing to the scarcity, and consequent dearness, of the cannel, the amount expended on this enricher by the London Gas Companies was so large in 1889 and 1890, that they were compelled to seek other means to keep up the illuminating power of their gas. At Beckton, a plant capable of making 6 million cubic feet of 25-candle carburetted water gas, after the improved Lowe system, has been erected; at the new works of the South Metropolitan Company, the Maxim-Clark process of carburetting with easily-volatilized petroleum naphtha has been adopted.

Although installations have been in satisfactory working for two winters, the information vouchsafed up the present does not allow a precise opinion to be formed as to the prospects of carburetted water gas in England. It is noticeable that the particular water-gas process adopted does not show any great economy in the production of the non-illuminating gas. At our meeting at Frankfort-on-the-Main in 1880, I was able to report upon some experiments carried out with a water-gas plant on the Strong system at the Frankfort works. It was proved that the process was accompanied by great loss of heat; only about half the calorific value of the coal or coke being realized in the water gas. Mr. Glasgow, who exploits the Lowe process in England, recently gave figures concerning the latest form of plant, which show that only 57 per cent. of the heating value of the fuel is utilized; the remaining 43 per cent. being lost. This relatively small improvement on the earlier results cannot of itself have turned the scale in favour of water gas. The analysis of the sources of loss of heat shows that certain of them, which are associated with the present process, may be diminished by suitable means. It was pointed out twelve years ago how greatly a high temperature in the generator reduced the amount of carbonic acid produced; Naumann and Pistor, as well as others, have carried out experiments which have increased our knowledge in this particular direction of the process of making water gas.

It is, however, of great importance to learn the exact conditions under which the steam is, as nearly as possible, completely decomposed by the incandescent fuel in the process of making water gas; for only a portion of the steam led into the generator is decomposed to form hydrogen and carbonic oxide or carbonic acid, as the case may be. Though theoretically only 2·5 lbs. of steam are required for the production of 100 cubic feet of water gas, in practice considerably more is used. This excess of steam is fatal to the economy of the process, not only on account of the fuel expended in its production, and on account of it subsequently requiring condensation, but also because it has a direct influence on the decomposition taking place in the generator. As there are no reliable observations recorded on this important point, one of my pupils (Herr Harris) has carried out experiments on the decomposition of steam by incandescent carbon at different temperatures, with results given in the following table:—

Decomposition of Steam by Means of Incandescent Carbon at Different Temperatures.

Mean Temp.	Composition of the Water Gas Formed. (Percentage by Volume.)			Steam Decomposed.	Steam Undecomposed.	Rate of Flow of the Gas.
	H.	CO.	CO_2.			
Deg. C.				Per Cent.	Per Cent.	C. Ft. per Min.
674	65·2	4·9	29·8	8·8	91·2	1·91
758	65·2	7·8	27·0	25·3	74·7	3·91
838	62·4	13·1	24·5	34·7	65·3	7·76
838	61·9	15·1	22·9	41·0	59·0	6·95
861	59·9	18·1	21·9	48·2	51·8	11·24
954	53·3	39·3	6·8	70·2	27·2	13·35
1010	48·8	49·7	1·5	94·0	6·0	13·04
1060	50·7	48·0	1·3	93·0	7·0	20·77
1125	50·9	48·5	0·6	99·4	0·6	23·95

The details of the method of conducting the experiments need not here be entered upon. Suffice it to say that steam was led over pieces of pure wood charcoal heated to a high temperature in a tube; the quantity of the steam, the composition of the gas produced, and the amount of steam undecomposed being ascertained by standard methods. The temperatures ranged from a dull red heat of 674° C. to a white heat of 1125° C. The experiments show that, the higher the temperature, the richer in carbonic oxide and the poorer in carbonic acid is the water gas produced. At 600° to 700° C., the decomposition of steam by carbon takes place, mainly in accordance with the equation—

$$C + 2H_2O = CO_2 + 2H_2;$$

and only 5 to 10 per cent. of carbonic oxide is formed. As the temperature rises, the decomposition approaches that most favourable to the water-gas process, expressed by the equation—

$$C + H_2O = CO + H_2;$$

or the carbonic acid decreases until, at about 1000° C., steam is decomposed by carbon to carbonic oxide and hydrogen—not more than about 1 per cent. of carbonic acid being formed.

Of equal importance with regard to the economical production of water gas is the percentage of the steam admitted that is decomposed in passing through the incandescent carbon. At low temperatures, quantities of carbonic acid pass over incandescent carbon without being reduced; similarly, great quantities of steam go over without decomposition. At about 700° C., only about 8 per cent. of the introduced steam is broken up; but the quantity increases as the temperature rises, until at 1200° C. decomposition takes place completely, and the produced gas is at the same time quite free from carbonic acid.

These facts have a most important bearing on the process of making water gas. At the commencement, a very high temperature prevails in the generator, and the steam is completely decomposed; but the abstraction of heat for the decomposition lowers the temperature of the fuel, and increasing quantities of steam pass out undecomposed, until about 800° C., or a bright red heat, when the greater part of the steam admitted passes out again unaltered—lowering the temperature, and requiring subsequent removal from the water gas by condensation. It becomes evident, therefore, how extremely significant for the economical working of the water-gas process is the production of as high a temperature as possible in the generator. The importance of this condition does not appear to have been sufficiently realized hitherto, since a cold air blast is still used in the generator; while experience with the blast-furnace shows how greatly the application of hot air favours the production of a high temperature and economizes fuel. It is not for me here to enter into technical details, and to discuss how the hot air blast can be applied to the water-gas process, without greatly sacrificing the simplicity of the apparatus; but many ways suggest themselves—such as by the use of the generator gas which is, to a great extent, wasted at present. We may safely assume that the water-gas process, as it has come to us from America, is capable of considerable advance in regard to economy; and with the lowering of the cost of production, there will be greater ground for its extension than is now the case. Notwithstanding this favourable prediction, I believe that water gas can scarcely, in the immediate future, play so important a part in Germany as in America, and perhaps in England, as the natural conditions with Germans are totally different.

In the last decade, a kindred industry to that of gas has extensively developed in Germany—viz., the manufacture of coke with collection of the bye-products. No value for lighting purposes is attached to the gas produced, which now serves only for heating. But, besides the coke, tar and ammonia are obtained; and in recent years benzol has been separated from the coke-oven gases. In Westphalia and Silesia alone, there are 1200 coke-ovens provided with means for collecting the tar and

* See Journal, Vol. LXII., p. 717.

ammonia; and the quantity of coal distilled in this manner is at least equal to the total bulk carbonized in all the gas-works of the German Empire. The extraction of benzol from the gases was first successfully carried out by F. Brunk at Bochum in 1887, by washing the gas in suitable apparatus, and afterwards distilling off the benzol. Although, volume for volume, the coke-oven gases contain little more than half the quantity of benzol in coal gas, the new source was so productive that, despite the immense requirements of the colour industry, a flooding of the market and an extraordinary fall in the value of crude benzol ensued—occasioning a depression in the price of tar, which keenly affected gas-works. The working up of tar would have ceased entirely if it had not been for the other valuable products from it, in the obtaining of which benzol was produced in a certain measure as a bye-product. The quantity extracted from the coke-oven gases in a year now amounts to about a million gallons; and if all the 1200 coke-ovens were fitted with the washing apparatus, the annual production from them would be about 1½ million gallons.

I have before pointed out that benzol is the constituent of ordinary coal gas which is the chief source of its illuminating power. If the benzol is removed from coal gas by cooling or absorption, the illuminating power falls to a few candles. Thus, in a measure, benzol is the natural carburetting material for coal gas; and in the quantities washed from coke-oven gases we have a rich source of enriching material, to which, up to the present time, sufficient attention has not been given. No enricher is necessary for making a gas of about 16-candle power when consumed at the rate of 5·3 cubic feet per hour, provided good gas coal is used and a very high make foregone. This gas contains about 0·28 gallon of benzol per 1000 cubic feet. The quality and yield are not, it is well known, solely dependent on the quality of the coal, but also on the method of distillation and the temperature employed. At too low a temperature, the coal is not completely decomposed, and the make of gas is low; at too high a temperature, the make increases, but the illuminating power is perceptibly deteriorated. As the effect of high temperature on illuminating gas has not been accurately observed, one of my pupils (Dr. Mayer) undertook some experiments to ascertain at what temperature the illuminants were decomposed. Coal gas was led through a porcelain tube, either empty or packed with particles of iron or carbon, at a known temperature. At 1100° to 1200° C., the illuminants were almost entirely destroyed; and the usually stable methane broke up completely to hydrogen and carbon. The composition of the gas before and after heating at 1100° to 1200° C. is given in the following table:—

Decomposition of Illuminating Gas on Heating at 1100° to 1200° C.

Composition of the Gas.		Volume after Superheating.	
Constituent.	Volume.	With Iron.	With Coke.
	Per Cent.	Per Cent.	Per Cent.
Methane (CH_4)	31·9	5·8	1·6
Heavy hydrocarbons (C_nH_m)—			
Ethylene, 4·5 p.ct.; benzol, 1·3 p.ct.	5·8	0·0	0·8
Hydrogen (H_2)	47·9	81·2	81·4
Carbonic oxide (CO)	8·3	5·8	10·2
Carbonic acid (CO_2)	3·5	1·2	0·9
Oxygen (O_2)	0·9	1·0	0·2
Nitrogen (N_2)	1·7	5·0	4·9
	100·0	100·0	100·0
Specific gravity		0·1825	0·2014

The decomposition of the gas is attended by an increase in volume from 1 to 1·4. The experiment shows that, at a temperature a little higher than that of gas-fired retorts, coal gas is decomposed, with separation of carbon into a mixture consisting chiefly of hydrogen and carbonic oxide, which burns with a blue flame. The volume of the gas is increased by almost one-half, chiefly through the breaking up of the methane, which sets free twice its volume of hydrogen. This behaviour of illuminating gas under high temperatures explains why we carbonize relatively small amounts of coal at one operation in our retorts, since we wish to preserve the illuminants. In large chambers like coke-ovens, the methane, and more especially the benzol, are for the most part decomposed in passing through the outer layers of hot coke, and a gas poor in these constituents and rich in hydrogen results. If a lighting gas is to be produced directly from coal, we cannot increase the amount of each charge indefinitely by employing large retorts or chambers, even though the works have to make several million cubic feet of gas per day; but we must adhere to the traditional relatively small retorts, and turn our attention to the various mechanical appliances which facilitate the production of large quantities of gas from a number of such retorts.

But another method of obtaining an illuminating gas has been hinted at previously. In place of directly producing a rich gas, we can apportion the work by first making a crude gas, and afterwards giving it the required illuminating power by carburetting with benzol; or, in other words, we synthetically make gas for lighting purposes from benzol and a poor crude gas, instead of manufacturing it directly. It has been shown before that such a synthetically-formed gas would possess all the important properties of ordinary gas. Nevertheless, the question whether a gas made by introducing hydrocarbons into a poor gas is permanent under the cold experienced in winter must be considered. Unfortunately, the term "carburetting" has in the past decade been associated with reminiscences of deposits in the mains, and loss of illuminating power during distribution. To clear up the question, I have carried out experiments on the constancy of illuminating gas under cold. Ordinary gas was led through glass vessels containing readily-volatile hydrocarbons, such as benzol, pentane, hexane, &c. The gas, mixed with the vapour of the hydrocarbon, was passed through a worm cooled to definite temperatures—10° C., 0° C., and — 10° C. The gas, thus saturated with the vapour at these temperatures, was tested by a photometer, and the quantity of hydrocarbon taken up by it ascertained at the same time. The results of a few of these experiments are recorded in the following table:—

The Permanency of Carburetted Gas at Low Temperatures.

Carburetting Material.		Temperature of Saturation with Vapour.	Illuminating Power at 5 Cub. Ft. per Hour.	Quantity of Carburetting Material Taken Up.
Hydrocarbon.	Boiling Point.			
	Deg. C.	Deg. C.	Eng. Candles.	Grains per C. Ft.
Benzol (C_6H_6)	80	+ 11	41*	75·0
" "	"	0	29*	35·0
Toluol (C_7H_8)	111	0	14†	7·5
Pentane (C_5H_{12})	37	0	62*	433·0
" "	"	— 4	42*	309·0
" "	"	— 11	36†	179·0
Hexane (C_6H_{14})	69	0	26†	94·0
" "	"	— 12	18†	36·0
Amylene (C_5H_{10})	40	— 11	47*	178·0

* Fishtail burner. † Argand burner.

From this table it is seen that coal gas saturated with benzol vapour at 11° C. contains 75 grains of benzol per cubic foot, and burns at the rate of 5 cubic feet per hour in a fishtail burner with an illuminating power of 41 candles. The same gas cooled to 0° (say, by melting ice) throws down 40 grains of benzol; and then, when burnt in the same manner, gives an illuminating power of 29 candles. By further cooling, more benzol is thrown down; and the illuminating power diminished still more, as I showed in my former paper. Gas carburetted with benzol to give a light of 30 to 40 candles would not be of a sufficiently permanent character to be distributed without loss of lighting power in the winter. But for general consumption a gas of only 15 to 21 candles is required; and gas saturated with benzol at 0° or 10° C. can readily be used for enriching ordinary coal gas to this degree. A portion of the main stream of crude gas is led aside through a vessel, in which it assimilates benzol vapour, and then rejoins the main stream and raises its illuminating power. On a previous occasion, I showed that, if the dilution be sufficient, the condensation will not be greater than with ordinary coal gas.

Toluol, which has a higher boiling-point than benzol, is contained in crude benzol, but is not so readily taken up by gas as the lighter homologue. Gas saturated with toluol at 0° C. contains only 7·5 grains per cubic foot, and gives a light of 14 candles when consumed in an Argand burner. Toluol is consequently of little value for carburetting; and care must be taken that, when crude benzol is used for the purpose, it shall contain as little as possible of the higher boiling aromatic hydrocarbons, toluol and xylol. A distillation of the hydrocarbon will readily show if it is free from them.

Pentane and hexane—the very volatile hydrocarbons from crude petroleum—are taken up in large quantities by gas. Thus a cubic foot absorbs at 0° C. 433 grains of pentane boiling at 37° C.; and the product burns with a flame much inclined to smoke, and yields a light of 62 candles when consumed in a fishtail burner at the rate of 5 cubic feet per hour. On cooling to — 4° C., 124 grains of pentane were deposited; and the gas had an illuminating power of 42 candles. Even at — 11° C., 179 grains of pentane remained in a cubic foot of gas; and the latter gave a light of 36 candles in an Argand burner. The higher boiling hexane, which occurs in crude naphtha along with pentane, more readily saturated the gas; and the latter, when cooled to — 12° C., was of 18-candle power.

Amylene is included in the table, as a representative of the ethylene series, for the sake of completeness; but it is of no practical importance for carburetting. It is evident, however, that coal gas can be raised to 15 to 21 candle power by the aid of the materials mentioned; and that condensation and deposition in the mains need not be feared.

We have now to consider the amount of benzol required for enriching gas, and the quantity with which the coke-ovens provide us. My former communication furnishes the answer to the first inquiry. On the average, a cubic foot of coal gas of moderate quality requires from 2 to 2·5 grains of benzol for raising its illuminating power one candle. To be on the safe side, let us take the higher figure. Then one gallon of benzol will raise 24,500 cubic feet of gas by one candle. The quantity of benzol washed from the coke-oven gases is, according to reliable estimates, about a million gallons, which would suffice to raise the illuminating power of 24,500 million cubic feet of gas by one candle, or 8167 million cubic feet by three candles.

It is evident that the gas industry should turn its attention to this source of enriching material. But it may be asked if such enormous quantities of benzol can be expected on the market at a low price if a considerable consumption takes place on gas-works for carburetting; and if the coke manufacturers can be relied upon to supply as much benzol as would be required. An answer must unhesitatingly be given in the affirmative. Even if the price of benzol falls considerably lower, the coke-works will not give up extracting it. Only a small proportion of the ovens throughout Germany are fitted with apparatus for collecting the bye-products, and not all of these extract the benzol from the gases. There is no doubt room for an enormous advance in this industry; and it need scarcely be feared that either a great advance in price or scarcity of this carburetting material is imminent.

If from the above it may be taken for granted that carburetting gas with benzol can replace the use of cannel without difficulty, and in many cases with economy, it may with advantage be considered whether the use of good gas coals may not be superseded by that of cheaper kinds, the gas from which could be subsequently enriched with benzol. The property which gas coals possess of yielding, by direct distillation, a gas containing about 17½ grains of benzol per cubic foot is in many cases dearly bought at their high figure. Taking the market prices of typical gas and ordinary coals in Germany in June, 1893, 1000 cubic feet of gas would cost 1s. 4d. and 1s. 2½d. from them respectively. The enrichment of the latter gas to the extent of 3 candles, to bring it up to the former in quality, would, at the market price of benzol at the same date, raise the cost per 1000 cubic feet to about 1s. 3¾d., or there would be a saving of about ¼d. compared with the cost of similar gas made directly from gas coal. But, in this computation, no account is taken of the value of the bye-products, which frequently turns the scale in favour of the caking coals. Nevertheless, the judicious introduction of carburetting will give the gas industry more freedom in the choice of coal; and this will react on the price of gas coals, which are now always in greater demand than others. Further, if the process of gas making be divided into two stages, in the first of which is produced a crude poor gas which in the second is carburetted with benzol, large gas-works will no longer be compelled to increase the number of retorts for an augmented make, but will be able to use large retorts approaching coke-ovens in size, and the operations of charging and drawing will be much simplified, and be less expensive than at present. In a sense, such a process may be regarded as analogous to the production of water gas; but the product is not heavily loaded with carbonic oxide, and bye-products are obtained. The subject is of sufficient interest to deserve investigation by practical tests on the large scale; and I hope the statements made above will give an impetus to work in the direction indicated.

In the discussion which followed the reading of the paper, Professor Hempel, of Dresden, stated his opinion that coke-oven gases were less fitted than water gas to form the basis of illuminating gas, since they invariably contained quantities of nitrogen, from which the latter was theoretically quite free. He considered the use of cold air and non-superheated steam in the manufacture of water gas a grave error. Dr. Strache, of Vienna, spoke in favour of the use of uncarburetted water gas for illuminating by the aid of incandescent burners, as advocated by him in a paper he read before the Chemico-Physical Society in Vienna last year.* Herr Klönne (Dortmund) and Herr Dicke (Fürstenwalde) also contributed to the discussion.

Institution of Civil Engineers.—At the monthly meeting of the members of the Institution last Tuesday, Mr. H. A. Blomfield, of the Moss Vale Water-Works, New South Wales, and Mr. A. F. Bruce, of the Strathblane (N.B.) Water-Works, were transferred from the class of associates to that of members; and Mr. O. F. Monier-Williams, of the Kingston (Jamaica) Water-Works, was elected as an associate member. Mr. Blomfield was a former student of the Institution.

State Inspection of Water-Meters.—A Bill introduced into the Massachusetts House of Representatives provides for the appointment of a State Inspector of Water-Meters, at a salary of $3500, in addition to office and travelling expenses. The amount of the salary and travelling expenses is to be assessed annually upon the water companies, cities, and towns using water-meters, in amounts proportionate to their respective water incomes. Every water company or department is also to provide proper tanks and scales, and furnish all labour and facilities required for testing by the inspector. The standard of measure is to be 62½ lbs. weight of water per cubic foot; and in no case is a meter to be kept in service when tests show a "variance from accuracy" against the consumer after having been at work six months. A progressive scale of testing fees is included. The Bill provides that "no new water-meter shall be sealed as correct that varies on the average in delivery from full to one-sixteenth of an inch flow more than 2 per cent. from the standard measure against the water department or water company, or more than 1 per cent. against the consumer."

* An abstract of this paper has been prepared; and it will be given in an early issue of the JOURNAL.

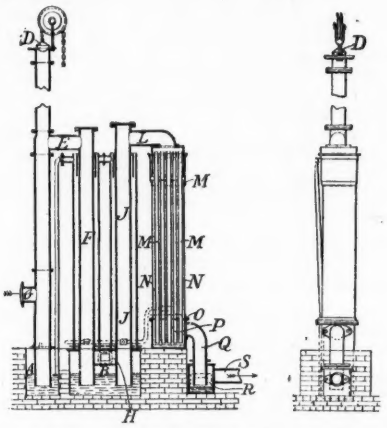
REGISTER OF PATENTS.

Incandescent Gas-Burners.—Imray, O.; communicated from Moeller, J., of Westminster. No. 124; Jan. 3, 1893.

The specification (not illustrated) of this invention mentions that the burners described in patent No. 15,286 of 1885, consist "of a network hood of metallic oxide, heated to incandescence by the flame of a Bunsen gas-burner, over which the hood is suspended;" but it has been found that the incandescent oxide of the metal thorium, when in a pure state, gives comparatively little light, but that when it has added to it a very small proportion (generally not exceeding 1 or 2 per cent.) of the oxides of certain other of the rare metals—such as uranium, cerium, terbium, neodymium, samarium, prazeodymium, yttrium, and lanthanum—it has a very high illuminating power. In order to produce a hood of this kind, according to the present invention, "nitrate of thorium, in the purest possible condition, is dissolved in water; to this is added 1 to 2 per cent. of solution of nitrate of one of the other metals above-mentioned, preferably uranium. A network hood of vegetable textile material is soaked in this solution, dried, and then subjected to heat over a Bunsen burner, whereby the vegetable fibres are burned away, and the metallic nitrates are converted into oxides, forming a network skeleton hood of the mixed oxides, which, when it is heated to incandescence over a Bunsen burner, gives out a very brilliant light."

Water Gas.—Paisley, J. R., of Colnbrook. No. 3815; Feb. 21, 1893.

This is an improvement on patent No. 15,797 of 1889; and it relates to the cooling arrangement there described; the object being to obviate the dust and other impurities entering the coolers with the gas, and thus choking the pipes leading to the hydraulic seal. This is attained by connecting at the bottom of each separate pipe of the coolers, other pipes forming traps contained in an open water-seal, so that the gas may pass from one pipe to the other without forming (as in the hydraulic box) a seal; and during the passage of the gas, the dust and other impurities drop into the additional pipes, and are sealed by the water therein—the level of the open seals being regulated by suitable means.

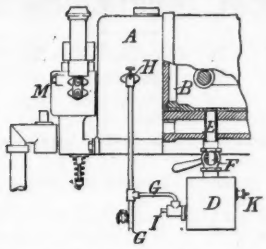


A and B are wells or seals (on which the cooler is fixed) provided with suitable overflows, and serving to trap tar and other bye-products before entering the surface cooler and hydraulic box. C is a branch-pipe to the producer and an inlet to receive the gases—also to be used as a chimney. The bottom open end descends to the well A, and is sealed by the water therein. D is a valve attached to the top of the chimney, for allowing the gas to escape when not required. E is a branch-pipe to the first water cooler, passing over an internal pipe F of the cooler. This pipe is of sufficient length to allow the water to form a joint as shown. H is a branch-piece with open ends to the well B, and connected to the next water cooler. A door is provided for cleaning F. J is an internal pipe connected to the branch-pipe H, both ends of which are sealed in the well B. L is a branch-piece fitting over the internal pipe J, and over internal pipes M (which pipes may be continuous below the plate or jointed to the plate); the pipe L being of sufficient length to allow the water to form a joint in the surface water cooler N. O is the hydraulic box, in which are fitted pipes P, corresponding to the pipes M, if jointed pipes are used. Q is an outlet-pipe leading into a second hydraulic box R. S is an outlet to the scrubber or holder.

Gas-Engines.—Bellamy, A. R., of Stockport. No. 6093; March 22, 1893.

The object of this invention is to arrange the starting of the gas-engine so that a mixture of air and gas at atmospheric pressure is first exploded while the piston is at rest. This pressure sets the engine moving; and after the piston has travelled a certain distance, communication is effected with another chamber containing a second charge of gas and air at atmospheric pressure, which charge is compressed, and then fired by the first explosion. A second and powerful impulse is thus given to the piston after it has been put into motion by the first explosion.

To effect this object, a reservoir or chamber is connected with the gas inlet and with the cylinder, as shown in the engraving. Here A is the cylinder, B the piston, D the reservoir or chamber, E a pipe connecting the reservoir D to the cylinder, F a tap or valve controlling the pipe E, G the pipe which supplies gas or explosive fluid through a back-pressure valve H to the compression space or chamber of the cylinder, and simultaneously through a back pressure valve I to the reservoir D, which is also provided with a valve K, to allow the products of combustion to escape.



At starting, gas is admitted through the pipe G to the compression space or chamber of the cylinder, and at the same time to the reservoir D. This simultaneously forms an explosive fluid mixture, at or about atmospheric pressure, in both places; the gas having driven before it a portion of the air or products from the compression space or chamber of the cylinder—preferably through the valve M in communication with the ignition-tnbe, as described in patent No. 4564 of 1893, and from the reservoir D through the valve K.

The first explosion is caused by the explosive fluid mixture in the cylinder coming in contact with the heated portion of the ignition-tube, in the manner described in the former patent; and when the first explosion takes place, the piston B is driven outward until it uncovers the port and pipe E communicating with the reservoir D. The flame from the first explosion immediately ignites the explosive fluid mixture in the reservoir; thus giving a second or supplementary impulse to the piston, whereby additional power is obtained for starting, and this without any sudden shock or jar. After the piston has reached the end of its outstroke, the valve F may be closed by hand (or automatically, if preferred), to shut off the reservoir from the cylinder.

Gas Motor Engines.—Bellamy, A. R., of Stockport. No. 7064; April 6, 1893.

The patentee states that the object of his invention is "to improve the construction and remedy certain defects which now exist in large gas-engines having more than one cylinder." He proposes to place the cylinders tandem—one behind the other—with the cylinders, crosshead guides, and crank-shaft, all mounted upon one long bed-plate; the crank-shaft having preferably a bearing on each side of the bed. The connecting-rod from the crank is pivoted to a crosshead, mounted in suitable guide-ways; and one piston-rod is connected to this crosshead. To each end of the crosshead is secured a rod; and these rods are connected at their other ends to a crosshead for the piston-rod of the other cylinder, which second crosshead also works in guide-ways on the bed-plate. Each cylinder is provided with its own arrangement of valves for admitting the gaseous mixture, igniting the same, and exhausting the products of combustion; all the valves being operated preferably by a single side-shaft driven from the crank-shaft. The pistons occupy the same relative positions in each cylinder; and the valves are arranged so that the explosions in the cylinders take place alternately, and thus tend to ensure an explosion at each revolution of the crank-shaft.

Gas Regulator or Governor.—Higginson, J. H., of Bolton, Lancs. No. 7400; April 11, 1893.

The illustration accompanying the specification of this "invention" shows a very familiar form of gas-governor; the patentee claiming that his appliance consists of "a metallic case, in halves, provided with inlet and outlet orifices and a flexible diaphragm. The inlet portion of the case is provided with a valve-seat, in conjunction with which operates a conical or other valve, mounted on a screwed spindle; the latter being attached to the diaphragm by a threaded nut, secured in any convenient manner. By means of the screwed spindle, the movements of the valve may be regulated to a nicety, according to gas-pressure and requirements—thereby dispensing with the old or present system of regulating by a series of weights. The upper end of the metallic case is provided with a cover, to allow of the screw being operated to regulate or adjust the valve as desired."

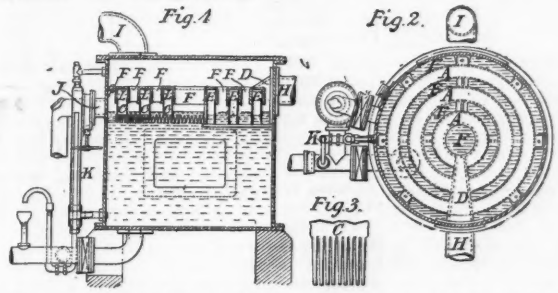
Gas-Engines.—Dawson, H. T., of Salcombe, Devon. No. 7426; April 11, 1893.

In the construction of this gas-engine, provision is made for the regular supply of gas and air mixed in suitable proportions, by means of a compound or duplex pump, worked by the engine, or by hand when the engine is not running. The pump consists of an external cylinder, open at both ends, but with a partition in the middle, carrying on each side of it a cylindrical projection concentric with the outer cylinder, and leaving an annular space between the two. Each end of the cylinder also contains a plunger fitting the annular space. In the centre of the plunger, there is also a cavity which receives the cylindrical projection upon the partition. When the engine is running, the hand-lever remains at rest; but the lever can be worked to obtain a supply of gas and air when the engine is not running. The two annular spaces are connected together by a passage through the partition; and in connection therewith, an air-inlet and an air-outlet valve are provided. Thus when either plunger is moved, gas and air are pumped separately.

There is also a receiver, with a partition dividing it into two chambers; and into these the gas and the air are separately compressed. When the engine is at work, the position in which the hand-lever is fixed regulates the pressure which can be generated in the receiver, so that, whatever the consumption of gas may be, the pressure can never rise above that to which the apparatus is set. The ignition apparatus receives a supply of mixed gas and air, from a box in connection with the receiver, provided with stop-valves, which can be opened more or less as required. Between the mixing-box and the ignition apparatus is a filter or strainer, consisting of a tube closed at one end, and with a series of annular grooves turned on its exterior, in which are numerous fine perforations. The tube is wound round with several thicknesses of fine wire gauze. The arrangement is such that the gas and air being admitted to the interior of the tube pass out through the perforations, and through the gauze; and the mixture then enters an outer tube or case, in direct communication with the heating chamber of the ignition apparatus. In this way, a complete admixture of the air and gas is ensured; and it is impossible for any flame to pass back from the ignition apparatus to the mixing chamber.

Washers.—Cripps, F. S., of Sutton. No. 14,783; Aug. 2, 1893.

The washer, according to this invention, "consists of such parts, and is so constructed, as to extract tar, ammonia, carbonic acid, and sulphide of hydrogen from coal gas, and to automatically discharge these impurities" from the apparatus.



The working part of the washer consists of a horizontal disc-plate A, having annular rings or flanges cast on the underside, to which are attached thin strips of sheet iron C, having the edges serrated, as shown in fig. 3. An entrance chamber or distributing-box D (tapered in shape in plan) projects from the side of the vessel containing the washer, extending to the centre of it, and having openings E on both sides, communicating with the spaces enclosed between the annular rings of the washing devices. The cast-iron disc-plate is perforated with annular openings F, for the passage of gas after it has been washed. The entire disc-plate A, with its devices complete, is fixed in a vessel having an inlet H for the gas on the side connected with the entrance chamber D and an outlet I above. When at work, the vessel is filled with liquor to a level sufficient to seal the dipping serrated edges of C; the level being regulated by an overflow-valve J. The tar is continuously drawn away from the lowest level of the washer by an overflow K, rendering periodical or intermittent flushing out of the apparatus unnecessary. A constant seal and pressure are therefore maintained; and gas never passes through the apparatus without being washed. The overflow K consists of two tubes—one inside the other. The outer or larger pipe is fixed in position, and is in direct communication with the tar in the lower part of the vessel, and with the gas in the upper part of it. The inner tube is adjustable in height. The tar enters and rises up the outer tube, and overflows into the inner one, passing out of the latter by the syphon-tube at its foot.

The action of the washer is as follows: The gas enters the distributing-box D, and passes out on either side, through the openings E, into the annular inverted channels or troughs L, which are sealed in liquor. The liquor is depressed inside these troughs, but rises on the outside of them, until the gas can force its way between the lower serrated edges of the dipping devices C. In doing so, the gas is brought into intimate contact with the water or liquor outside; the gas, being split up into a number of minute streams, bubbles through the liquor, and escapes by the annular opening F, in the top of the disc A, into the upper part of the vessel, and away by the outlet I.

Obtaining Compression in Gas-Engines with Slow Combustion.—Brünler, Oscar, of Eutritzsch-Leipsic, Germany. No. 21,775; Nov. 15, 1893.

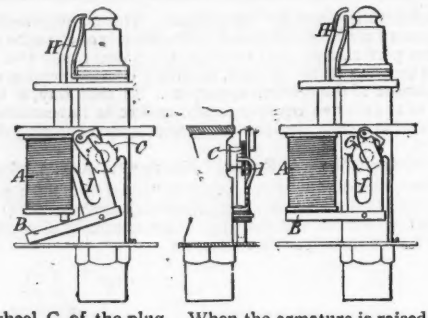
This invention relates to a process used in gas-engines with slow combustion, for the purpose of obtaining a compression in the working cylinder at the end of the backward motion of the piston. As in the case of steam-engines, this compression serves to avoid shocks, and to discharge the "inlet-organs," which are under the high pressure of the compressed air and of the compressed gas.

In order to accomplish this, the valve of the combustible supply-pipe is closed after the piston has made part of its forward stroke, while the valve of the pressure air-supply pipe is still left open for a short time. Thus the whole of the ignition-chamber is filled with pure pressure-air. When the piston has nearly completed its backward motion, the outlet-valve is closed, while the inlet-valve is opened, so that combustibles enter the ignition-chamber. There the combustibles find air; and the mixture ignites, in consequence of the heating of the chamber. Through this, says the patentee, the pressure is considerably increased, so that the intended compression is accomplished.

Lighting and Extinguishing Apparatus for Gas-Burners.—Orling, E., of Stockholm. No. 22,858; Nov. 28, 1893.

This gas-burner lighter comprises an electro-magnetic armature, which when attracted opens a spark-generating contact placed near the burner, and at the same time (by means of a pawl) turns the plug of the gas-cock, which is provided with a ratchet-wheel. The objects of the improvements are: "To effect an accurate movement of the plug, so that the latter will never remain in the half-closed or half-open position; the combination or arrangement of the apparatus in such a way that the manufacture is substantially facilitated; the arrangement of the moveable electrode in two parts; the fastening of the stationary contact-piece belonging to the contact, in such a manner that there will be no fear of its loosening by the heat; and, lastly, so arranging the apparatus that a number of gas-flames may be lit or extinguished one after the other by the use of a single battery."

As shown in the engraving, the apparatus comprises two electro-magnets A, one behind the other. The armature B has an upright arm, to which the pawl is fixed; the pawl being in engagement with the



toothed wheel C of the plug. When the armature is raised, the plug is turned, and the sliding-bar lifted. The bar constitutes one of the contacts; and it rests with its upper crooked end against the stationary contact H. The gas, when turned on, is lit by the spark produced at the opening of the contacts. In order that the turning of the plug may be exactly determined, the armature is provided with a second arm I, oscillating with the armature; and therefore, in the ascending movement of the latter it engages by its upper end with one of the teeth of the wheel C, and prevents its further movement. The inclination of the teeth of the wheel C is such that it coincides with the curve described by the top of the arm I, so that the wheel is still held even though the armature vibrates without falling. The stop formed by the arm is thus very reliable and easy to adjust; as for this purpose it is only necessary to bend the arm or the end of it a little. In order to prevent the plug returning when the armature is falling, there is provided on the opposite side of it with relation to the arm I, a spring hook, likewise engaging with the toothed wheel C.

APPLICATIONS FOR LETTERS PATENT.

3522.—Buck, W., "Regulating the compression and ignition of the charge in gas or oil engines." Feb. 19.

3558.—Golby, F. W., "Purification of combustion gases and utilization of the heat contained therein." A communication from H. Leffler. Feb. 19.

3600.—Best, R. H., "Gas-joints." Feb. 20.

3630.—Nixon, J., "Burners for producing heat." Feb. 20.

3649.—Stevens, J. H., "Gas or other measuring or delivering mechanism to be set in operation by a coin or coins." Feb. 20.

3665.—Evers-Swindell, H., "Manufacture of gas-retorts and other tubular objects of fire-clay or earthenware." Feb. 20.

3769.—Rogot, G., "Regulating motors operated by gas, petroleum, or other combustible fluids; distributing the said gas or fluids; and carburetting the air used therewith." Feb. 21.

3817.—Young, R., "Atmospheric gas jets or burners for heating tools, vessels, and the like." A communication from W. W. Cabena. Feb. 22.

3859.—Thompson, W. P., "Electric gas-lighting apparatus." A communication from M. Ulmer. Feb. 22.

4006.—Pittler, W. von, "Gas and oil engines." Feb. 24.

4053.—Laing, J., "Manufacture of gas from mineral and other oils and tars." Feb. 26.

4054.—Moeller, J., "Burner for incandescent gas-lights." Feb. 26.

4109.—Hobson, W., "Preventing the fraudulent use of gas and protecting gas consumers." Feb. 27.

4111.—Duke, J. F., "Automatically lighting gas." Feb. 27.

4139.—Shrewsbury, G., "Cooking-stove for gas or oil." Feb. 27.

4166.—Parker, J., "Preventing the bursting of water-pipes." Feb. 27.

4189.—Pinkney, C. W., "Manufacture of gas suitable for use in gas-engines or for heating purposes." Feb. 27.

4272.—Barrett, C. A., "Preventing the fraudulent operation of coin-freed machines." Feb. 28.

4283.—Imray, O., "Manufacture of combustible gas." A communication from La Société Anonyme des Moteurs Thermique Gardie. Feb. 28.

4360.—Greenall, J. N., "Supports for pipes." March 1.

4399.—Brown, R., "Gas-lamps for lighting streets or the like." March 2.

4408.—Jack, T. B., "Spreader for gas-lights." March 2.

4426.—Lea, J. P., "Oil and gas engines." March 2.

4430.—Groombridge, C., and South, W. A., "Propelling or forcing or exhausting air or gas." March 2.

4468.—Hawkins, H. and S. H., "Elastic hydrocarbon gas generator." March 3.

4503.—Meyer, S. W., "Water-pipes." March 3.

4504.—Warner, W. J., and Cowan, W., "Gas-meters." March 3.

4519.—Foveaux, J. F., "Lighting and heating apparatus." March 3.

The Arrol-Foulis Retort-Stoking Machines at the East Greenwich Gas-Works.—During last summer Messrs. Sir William Arrol and Co. fitted up four of their Arrol-Foulis retort-charging machines at the East Greenwich station of the South Metropolitan Gas Company. These machines, together with the four Foulis drawing-machines which were already in use at these works, have now been in operation for some months, and have given much satisfaction; the results obtained being considered particularly good.

Proposed New Reservoir for Thornton.—It is the intention of the Thornton Local Board to augment the storeage capacity in connection with their water-works; and for this purpose they have applied to the Local Government Board for sanction to borrow £6000. The usual inquiry was held by an Inspector of that body (Mr. W. J. B. Clerke) on the 2nd inst.; and it was then stated that the existing reservoir is only capable of holding 1,000,000 gallons, while the daily consumption is 35,000 gallons. It was also mentioned that the suggested reservoir would occupy about 8 acres. There was no opposition.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, March 7.

(*Before Mr. Justice* Vaughan Williams, *sitting as an Additional Judge of the Chancery Division.*)

In re the North British Water-Gas Syndicate, Limited.

The hearing of the petition presented by two contributories for the compulsory winding up of this Company (see *ante*, p. 389) was resumed to-day.

Justice Vaughan Williams said that, since the case was last before him, he had carefully gone through the papers, and had come to the conclusion that it was unnecessary to have the witnesses examined. The question as to whether the substratum of the Company had gone was beside the matter, as the concern was now in voluntary liquidation. The only point he had to consider was whether the shareholders were likely to be prejudiced by the continuance of the voluntary liquidation.

Mr. Macaskie urged that the voluntary liquidation was not a real winding up, but a scheme for the purpose of carrying on the same business with other persons. If there were a winding up by the Court, he should have an opportunity of inquiring into the promotion and formation of the Company, and thus be able to defeat the so-called amalgamation scheme. By means of the machinery of winding up, his clients were compelled to continue in a business which had no substratum. The Company had been in existence for five years, and, with the exception of £12, had lost the whole of their capital.

Justice Vaughan Williams thought that, as a large majority of the shareholders were in favour of the business being sold, he must give effect to their wishes; but the Company, having gone into voluntary liquidation, had no right to force dissentient shareholders to become shareholders in the new concern.

Mr. Everitt, Q.C. (with him Mr. Eve), said the agreement to sell to the new Company was entered into long before the Company went into liquidation. The sole object of winding up was to relieve shareholders of their liability in respect of the 30s. unpaid on the shares.

Mr. Whinney, for the Amalgamated Water-Gas Company, and Mr. Butcher, M.P. (with him Mr. Farrer), for creditors, opposed the petition.

Justice Vaughan Williams, in delivering judgment, said that, so far as the dissentient shareholders were concerned, he thought they were placed in a position of considerable hardship; but still it was their business, before joining the Company, to examine the Memorandum and Articles of Association, so as to see what their position would be. The Company was formed in 1889; and, with one small exception, had never attempted to do any work. It was said the reason the Company had abstained from carrying on any business was that unforeseen difficulties had arisen. In 1892 the Company, finding their assets largely exhausted, and with a liability of £49,000 to the parent Company, looked about to see what was the best thing to be done. Thereupon an agreement was come to which, although it was really an agreement for sale to a new Company, was no doubt, in effect, an agreement for amalgamation. The shareholders, in the exercise of the power conferred by the Memorandum, made an agreement with a new Company—the parent Company being also a party to it. As very often happened when these compromises were come to, the result was that the vendors got back anything valuable, which they might have sold originally, for a nominal price. Still it appeared to him that the contract for sale was one which it was within the power of the shareholders to make; and he had no right to make a compulsory order merely to enable dissentient shareholders to get rid of an arrangement of which they did not approve. The petition would therefore be dismissed, with costs.

MANCHESTER WINTER ASSIZES.—Wednesday, March 7.

(*Before Mr. Justice* Day.)

The Mayor, &c., of Salford v. Samuel Hunter.

This was an action brought to recover from the defendant the sum of £416 for costs incurred by the plaintiffs, which defendant had agreed to pay.

Mr. Yates, Q.C., and Mr. Roe-Rycroft appeared for the plaintiffs; Dr. Pankhurst for the defendant.

Mr. Yates, in opening the case, explained that Mr. Hunter was formerly Gas Engineer to the Salford Corporation; and the action was brought to recover from him the sum of £416 for costs incurred by them which, under an agreement dated May 17, 1891, defendant agreed to pay. The defence set up to the action was that the agreement was an illegal one; that it had been released by release under seal; and that the claim for costs was not maintainable because the Town Clerk, being a salaried official, could only recover costs out of pocket. For about seven or eight years prior to 1887, the defendant held the position of Gas Engineer; and it was believed and afterwards ascertained that, while acting in that capacity, he received bribes from colliery proprietors in order to induce the Corporation to take their coal for the gas-works. On May 17, 1887, an action was commenced in the Chancery Division of the High Court against Hunter and another Gas Engineer, claiming £2250, which it was alleged they had received in bribes, and secondly claiming payment of all the sums then due. The only persons who knew what had been given and received were the person who gave the bribe and the person who received it; and the Corporation were unable to obtain any information apart from those persons. Having commenced actions against most of the people who had dealt with the Corporation, they entered into an agreement with Hunter, under which the defendant was to deposit securities to the amount of £10,000 in the name of the Mayor of Salford and Mr. J. C. Walker, his own Solicitor.

His Lordship remarked that he thought the case had been before him in some form before.

Mr. Yates replied that his Lordship tried the action against Ellis Lever at Leeds, in which the Corporation sought to recover a bribe from the defendant. Lever set up the defence that he was included

in the agreement; and the Divisional Court were subsequently divided as to whether the agreement was legal.

Dr. PANKHURST: All the Judges were agreed that the document had no binding effect.

Mr. YATES: The verdict at Leeds was for the plaintiffs, who recovered £3000. His Lordship's ruling in that case, which was not on the agreement, was upheld. Proceeding, he said the gist of the agreement was that Hunter was to deposit securities to the value of £10,000; that the Corporation were to proceed against the persons who had bribed him; and that by so much as they recovered the £10,000 would be diminished, in order, practically, that Hunter might not pay the money twice over. The whole tenour of the agreement was that £10,000 was to be the amount taken as the sum Hunter had received in bribes, and that the £10,000 was to go into the coffers of the Corporation. A further clause in the agreement stipulated that on Dec. 31, 1889, in case the Corporation should have been successful in recovering any sums of money, the securities, or a part thereof, should be released, the sum of £10,000 should be paid over to the Corporation, and Hunter should in addition pay to the Corporation all costs incidental to the actions or any other proceedings. What happened upon that was this: After a certain time £1275 had been recovered in actions; and it was found that no more could be obtained. The costs were still owing to the Corporation, and had to be deducted from the sums recovered. Hunter and the Corporation were anxious that the matter should come to an end; and therefore a release was entered into on June 4, 1890. The space for the £1275 was left blank, because at that time the costs had not been taxed; and it was agreed that they should be taxed, and the net amount afterwards put in. Counsel argued that Hunter, having obtained all the benefit from these transactions, was not entitled now to turn round and say he would refuse to abide by the burden.

Mr. *Samuel Brown*, the Town Clerk, gave evidence corroborating Counsel's statement.

Cross-examined: Under the terms of his appointment, he was bound to do legal work at a salary. As against the Corporation, he had no claim for costs. If he recovered costs against Hunter, the money would go into the pockets of the Corporation.

His LORDSHIP: Then you carry on the business of a Solicitor for the benefit of the Corporation?

Witness admitted that it practically came to that.

Dr. PANKHURST contended that the document on which the action was based was one on which plaintiffs could not sue, because it was not under the seal of the Corporation, and was not binding at all.

His LORDSHIP: The Corporation might advance that argument, but not Hunter, because the document is signed by Hunter.

Dr. PANKHURST held nevertheless that the document was illegal, and called attention to an opinion pronounced on it by Mr. Justice Vaughan Williams, who declared it to be "illegal and *ultra vires*."

His LORDSHIP said the document might be illegal, but that was not Mr. Justice Williams's judgment. It was simply an expression of opinion on something that arose in the course of the case. Having given that opinion, Mr. Justice Williams concurred in the judgment of his colleagues.

Dr. PANKHURST pointed out that, under the agreement, it was stipulated that the more the Corporation obtained, the less Hunter would have to pay, and that Hunter was to give evidence for the Corporation, and was to decide what the contractors ought to pay. Was there ever, he asked, such a case as that known before? He also directed his Lordship's attention to the circumstance that no provision was made in the agreement for a case in which part only of the sum claimed might be recovered. He added that if Hunter paid the money for which he was being sued, the effect would be that the Corporation would receive it in a lump—not as costs incurred, but in benefit of the rates generally. He strongly urged that the Corporation could not legally enter into the agreement upon which the action was based. It was quite beyond public policy and public morality. To what extreme of extortion could not such an agreement be carried? The release stood on a totally different footing, and put an end to the agreement. In any event, he held that nothing could be recovered, except the actual costs incurred by the Corporation from the date of the agreement to Dec. 31, 1889.

His LORDSHIP, in giving judgment, said that, after listening very carefully to Dr. Pankhurst's exhaustive argument, he could not concur with him that the agreement was invalid. Hunter signed it; and in Hunter's breast, and solely in his breast, was the information which the Corporation required. The Corporation urged him to make some restitution. He agreed to do so, and deposited securities in the bank satisfying the Corporation to the extent of his admitted liability. The Corporation thereupon said: "We will assist you by seeing how much we can recover from those other persons, you undertaking to pay the costs;" and on that footing the actions were brought, and some of the money recovered. He could see nothing that was illegal in the transaction. It was true a colleague of his had expressed opinions on the agreement which were very unfavourable to it; but that question was not really before the learned Judge, and the rest of the Court expressed no decided opinion on the subject. Nor did the Court of Appeal do so when the case was carried there. His (Mr. Justice Day's) decision was that there was no illegality in the transaction. The costs, it was said, were not recoverable because, by some arrangement between the Corporation and the Town Clerk, the latter did not charge the former ordinary solicitor's costs. He did not think it lay in the mouth of Mr. Hunter to set that plea up at all. The Corporation were not bound to employ their Town Clerk to transact solicitor's business unless they thought fit to do so. Here they had thought fit to do so; and the costs incurred were the ordinary costs between solicitor and client. He decided that the Corporation were not disentitled to recover the ordinary costs of litigation as against Mr. Hunter. With regard to Dr. Pankhurst's contention that the Corporation were only entitled to recover costs for the period between the dates set out in the agreement, he held that the release did not purport to be a release of this liability in any shape or way. If the parties themselves had not agreed that this liability should be released, he did not see why he should construe what they had done into such an agreement. He decided that there was no release whatever of the liability. His judgment would be for the plaintiffs, with costs.

MISCELLANEOUS NEWS.

SOME NOTES FROM AMERICA.

From Our Own Correspondent.

Detroit (Mich.) has seen so many gas fights, that it may be well to note that the city is very likely to be free from such warfares for the next 30 years, by reason of the understanding that has been arrived at between the Municipality and the Gas Company; and as the trouble was noised abroad very greatly, it is well to revert to the subject now, and note a few of the salient points of the agreement. As the subject has been treated before, it is not necessary to go back to the beginning of the difficulty, but to take up at once the ordinance which was agreed upon by Mayor Pingree and the representatives of the Gas Company. The main features of the document were that the price of gas for illuminating purposes should be reduced from $1·50, the present rate, to $1 net, or $1·15 less 15c. for cash payment, on July 1, 1894, and that "the price of gas when used for fuel purposes be reduced at once to 80c. ten per 1000 cubic feet. The price of illuminating gas to be reduced to 90c. net when the consumption reaches 600 millions, and to 80c. when the output becomes 800 millions. The candle power of the illuminating gas to be 18. The consumer to have the right of having his gas-meter examined by the City. The franchise to run for 30 years; and, at the end of that period, the City to have the privilege of purchasing the plant at a figure to be arrived at by arbitration. Twice a year the Company must file with the City a sworn statement, showing the amount of the capital stock of the Company, and the amount of its bonds, the names of its stockholders and officers, the amount of gas (both artificial and natural) sold during the six months, and its gross income. The Gas Company to open streets only on the consent and under the supervision of the Board of Public Works." It was evidently anticipated that, as the Mayor was the leader in the fight on behalf of the City, any agreement made by him in the matter would be readily assented to by the City Government. But politics soon entered into the question; and it was at once apparent that, if the ordinance was "rushed through," it might redound too much to the credit of the political party to which the Mayor belonged. Objections were therefore raised by those of a different political persuasion. One of the first points made was that in the output of 600 or 800 millions which was to control the price, the amount of fuel gas sent out should be included. The annual output now being only about 250 millions, it was claimed that 90c. and 80c. gas was a long way off. The ordinance was finally reported upon by the Committee on Streets; and in their report the compromise was nearly upset, as, in addition to some minor provisions, the following was inserted: "Should said Gas Company at any time cease to furnish natural gas, and undertake to supply a cheaper quality of gas for fuel purposes than that furnished for illuminating purposes, the price to be charged consumers for such manufactured fuel gas shall be determined by a Board of Arbitration." Against this amendment the Company vigorously protested; claiming that it would be impossible to secure the capital which would be necessary for the construction of a fuel-gas plant when the price to be received for the product was uncertain, and subject to arbitration. Continuing, the Company said they would prefer to go on with the present litigation in Court to accepting such terms. Notwithstanding this protest, the ordinance, as amended, was adopted by the City Council; and, after being signed by the Mayor, was forwarded to the Company for their acceptance or rejection. On account of the firm stand made by the Company against this amendment, it was generally supposed that the ordinance would be rejected by them; but they finally decided to make the best of the situation, and accept the terms offered. This they finally did, and deposited with the City a bond, in the sum of $100,000, as required by the ordinance. The Company immediately commenced to lay pipes on Woodward Avenue, so as to connect their east and west side stations. This was the job the Company were attempting to do last summer, when it was stopped by the Court on the petition of the City. This was the real commencement of hostilities; and the recommencement of the work marks the opening of peace.

Toledo (Ohio) has been considering the matter of a new contract for electric street lighting; and I mention it merely to give some figures. It was stated by one of the citizens, who was opposed to the granting of a new contract to the old Company, that in a town in Michigan called Battle Creek the Company had been getting $75 a year for arc lights; and upon another Syndicate offering to form a new Company on the basis of $62·50 per lamp per annum, the old Company immediately cut their price in two, and offered to perform the service for $37·50 a year. Such cuts as these are apt to engender in the public the feeling that the price of electric service is very flexible, and to create erroneous impressions. As a matter of fact, the price would not much more than cover the interest and depreciation. In opposition to these figures, Mr. Faben, the Manager of the Gas and Electric Light Company, said the price he had offered—viz., $100 a year for a 2000-candle power arc, all and every night—was as low as it could be supplied for, allowing for a return of 6 per cent. on the capital; and I think Mr. Faben is pretty nearly right.

The price of gas at San Francisco is to remain unchanged, from present indications; and it is well so, as the rate is reasonable and fair, all things considered. This is apparently the opinion of Mr. J. Bradshaw, who is described as a stockholder in The Gaslight and Coke Company of London, and also in the Metropolitan Gas Company of Melbourne. Mr. Bradshaw was in San Francisco recently; and, in the course of a newspaper interview, he made comparisons between the conditions obtaining in that city and in Australia. He deduced there from that the rate at the former place was reasonable; or, as he put it, the people evidently did not appreciate how well they were being served.

A decision has just been given by the Gas Commissioners of Massachusetts which is of considerable importance. The Board had previously, on a hearing for a reduction in price, fixed at Chelsea the rate *flat*—that is, no allowance was made for a rebate for cash payment;

and the decision referred to was on a re-hearing of the case, on the petition of the Gas Company that they should be permitted to charge a gross and a net price. The Commissioners decided to allow this. The revised decision is certainly an important one, as it is the almost universal custom among gas companies in America to charge for the gas a certain price, with a rebate of a stated sum per 1000 cubic feet if the account is paid before a specified date—generally ranging from the 10th to the 15th of the month in different cities. To do away with this privilege would certainly add greatly to the cost of collection; and the gas companies in Massachusetts are pleased that the case has been thus decided on the re-hearing.

The tendency towards the municipal ownership of lighting plants, now becoming more general throughout America, is further illustrated by the report of a Committee of the Government of Kansas City, upon the application for a charter by a Company—or rather a Syndicate that proposes to blossom out into a Company, if it can obtain the necessary franchise. The Committee, in rejecting the proposition, insist upon two points—viz., that the City Authorities are to have the right to purchase the plant, and also to have a share in the net earnings of the concern. This idea of giving a city a share of the profits is becoming unpleasantly popular.

In a previous communication (see *ante*, p. 77), I spoke of lighting matters at Washington (D.C.), and alluded to the arguments put forward in favour of the City doing its own lighting. The subject has been somewhat further advanced—though it will probably never go very far—by the East Washington Citizens' Association, which has launched out boldly on this subject. The Committee, in the course of their report, say: "So popular and so beneficial has municipal ownership proven in Europe, that in Great Britain nearly two-thirds of the municipalities own the gas-works, sell pure coal gas at from 50c. to 60c., and add to their revenues from $100,000 to $200,000 per annum; and on the Continent this plan is spreading rapidly." The Committee did not add that English cities are governed differently from those in America. The Association finally adopted a preamble and resolutions setting forth the beauties of municipal lighting, and calling upon Congress to grant the necessary authority to permit the Municipality to carry out the ideas of the Association.

At Cambridge (Mass.), a city across the Charles River from Boston, and the seat of the Harvard University, the City Council have called upon the Gas and the Electric Light Company to file a schedule of their respective properties, as they have a right to require by the Municipal Lighting Act. This action would indicate that the talk which has been going on in the city anent the purchase of the two lighting plants is serious. The Cambridge Gas Company have been very fortunate in being able to accumulate a large reserve fund; and the papers are now publishing in very large type the amount of that fund. These papers inform the citizens of Cambridge that the Company have a cash balance of $22,000, and investments amounting to $107,000, besides a large surplus invested in their plant. It is contended that these facts indicate excessive profits; and therefore either a lower price for gas or the plant operated by the City is desired.

The subject of the municipal ownership of lighting plants excites interest in the West as well as in the East, as is evidenced by the accounts before me of an agitation on this subject at Denver (Col.). The citizens assembled there in mass meeting, and protested against the price now paid for arc lights in the streets—$150 a year—and passed resolutions calling upon the City to put up its own plant. As would naturally be expected, many wild statements were made at the meeting. Thus we read of one party, who is described as an ex-Mayor, saying he had investigated the question, and found that if the City erected its own plant, it would pay for itself in four years, besides paying 6 per cent. upon the investment during that time. How some electric light managers would like to find a portion of the profits they hear about at such meetings as these! But, to return to the subject, another speaker gave the cost of a 400 arc light plant at $174,000; and the cost of maintenance at $93 per lamp per annum, including interest at 6 per cent. However, in the every-day running of an electric light plant, we find many items not down on the enthusiast's prospective expense-sheet. As illustrating another phase of the municipal lighting question, I might note the fight now going on at Patterson (N.J.), where the Mayor is endeavouring to have the citizens embark on the troublous seas of municipal lighting. Much discussion has taken place there as to the cost of an electric lighting plant, and the expense of maintenance; and now the Westinghouse Company offer to erect plant of 800 arc light capacity, at the following figures: Electric and steam plant, $91,800; building, $8000; pole-line construction, $44,000; supervision, $5000—total $148,800. Maintenance for a year is put at $34,000. As the sum of $80,000 a year is now paid, this will be a hard proposition for the established Electric Light Company to get away with, provided it is made in good faith. The estimate is certainly absurdly low.

The number of Edison lamp decisions given from time to time, and the variations in the results arrived at by the several Judges, tend to surround the subject with a great deal of doubt and uncertainty. Many of the recent pronouncements have been in favour of the Edison Company; but now we have a decree of a reverse order. The latest decision is by Judge Ricks, of Ohio, who says the Edison lamp patent expired, or should have done so, on Nov. 10, 1893—that is, at the date of the expiration of the English patent. It is well known that, if a foreign patent for an invention is taken out before an American one for the same invention is issued, the American patent must expire as soon as the foreign one. It has, however, also been held that, for this rule to apply, it must appear that the foreign patent was actually granted before the American one; it is not sufficient that it should have been applied for before the American one was issued. In the Edison case, the English patent, though applied for before the American one, was not granted until that patent came out. The law upon this point not having been settled till recently, the Edison people, acting under an erroneous opinion of Counsel, caused to be inserted in the patent, about a year after it was granted, a statement substantially to the effect that it would expire on Nov. 10, 1893—the date of the expiration of the English patent. It has been held that such a recital is superfluous, as the date when a patent shall expire is something which the Courts should decide; and in 1893 the statement was expunged. It was, however, argued before Judge Ricks that, inasmuch as the patent had contained for some time the statement referred to, the Edison Company were now estopped from denying its truth. As the full text of the Judge's decision has not as yet been published, I cannot do more than note the decision to which he has come.

Gas affairs in Philadelphia have been very exciting of late. There have been many propositions in relation thereto before the City Government; but as yet only one of them has been disposed of—viz., the price at which gas shall be supplied. Other matters which the City Fathers have been considering are whether they shall continue to buy water gas wholesale, as they have done since 1888, or make all the gas they require; and, incidentally, the scheme of selling their entire gas property has been broached occasionally, but has not appeared to meet with much favour. The question of reducing the price of gas came up on a recommendation made some time ago by the Director of Public Works that the price of gas should be lowered from $1·50 to $1·25 per 1000 cubic feet. But some members of the Government seemed to have an idea that, if a 25c. reduction was a good thing, a 50c. drop would be better; and so an ordinance was introduced to make the rate $1 per 1000 cubic feet. Much discussion took place on the subject, as it was generally held that the City could hardly meet expenses on this basis. But the cry of "Dollar gas" was popular; and it finally passed the Common Council on the 27th of December, by a vote of 62 to 20. As showing the spirit in which officials of cities are apt to consider such a question as the present one, I will quote the Chairman of the Finance Committee, who, when the subject was under discussion, remarked: "The Controller's figures are but estimates; and the reduction in the price of gas would not be noticeable till the end of the year, when an appropriation could be made." It is so easy for a City Government to make an appropriation to meet a deficiency, that it may well be advanced that here is another reason against an American municipality going into business; and it matters little whether that business is supplying gas, electricity, or groceries. Surely, the point for consideration was whether the City could sell gas for $1 per 1000 cubic feet, and have reasonable expectation of coming out whole in the transaction, and not whether an appropriation could be made to meet a loss. However, as already noted, the ordinance was passed by the Lower House of the Municipality, and then went to the Upper Board—called the Select Chamber—where it came up for discussion on the 4th of January. The ordinance here met with considerable opposition at the outset. One member remarked on this side of the question that, when the City was in a position to sell gas at $1, without it being a hardship to the non-consumer, then the price should be reduced; but, according to statistics, the City did not occupy such a position that day. In his judgment, the City could not make the price $1 without imposing a wrong or injustice upon the non-consumers of gas. He went on to say that, according to the statistics furnished at least, 50 per cent. of the buildings in Philadelphia were without gas. The City was dependent upon the revenue of the Gas Department for a given sum of money to enable it to meet the appropriations made for this year; and to reduce the price would cause a deficiency, which would mean an increase of taxes. The non-consumer of gas would be compelled to pay for the luxury of the consumer; and this, in his opinion, was a wrong thing to do. He had been informed that the consumption had fallen off a million cubic feet a day. "We are told," he added, "that the City is paying an average price of between 58c. and 59c. to put gas in the holders, and the cost of distribution and the loss from leakage is 40c. additional; so that you have a total cost of 99c. for gas in the holder. I am willing to put the price of this commodity at the lowest possible figure; but I do not think we have reached that point yet." When it appeared that the ordinance would pass, many of those who had opposed its passage hastened to get under cover, so that the measure was agreed to by a vote of 33 to 1. The Bill then went to the Mayor; and for a day or two there was some question whether or not he would approve it. He finally did so; but he evidently proposes that the Council shall bear the responsibility of the measure. He says: "After the most careful investigation and consideration of the whole matter, Select and Common Councils, which have a most intimate acquaintance with, and knowledge upon, all questions relating to the City's finances, and know of all her obligations which must be met this year, and of the resources from which to meet them, have decided that the City can furnish gas at $1 per 1000 cubic feet without affecting her finances, or creating any deficit whatever; and if this be the case, the people of Philadelphia are entitled to the benefit of any reduction which it is possible to make. I have therefore immediately approved the ordinance." So Philadelphia has now "dollar gas." The following gives the prices since 1865: 1865 to February, 1868, $3; February to August, 1868, $2·40; August, 1868, to February, 1870, $2·55; February, 1870, to March, 1876, $2·30; March, 1876, to 1880, $2·15; March, 1880, to October, 1882, $2; October, 1882, to July, 1884, $1·90; July, 1884, to April, 1885, $1·70; April, 1885, to April, 1887, $1·60; and since that date, $1·50. The query now seems to be: How is the City going to meet the extra demand to which the reduced price will naturally lead? "The Director of Public Works says that, unless he is given money with which to increase the capacity of the works, no greater quantity of gas can be made than is being produced at present. Some more water gas could be made at one works; but there is insufficient holder capacity anywhere in the City to store it for distribution.' Other apparatus essentially necessary to an increased supply are purifiers. Those at present in use at the various works are only of sufficient capacity to deal with the present output. It is likely that large expenditures will also be necessary to increase the distributing system—in fact, there has probably been more complaint in Philadelphia of the inability of the consumers to obtain an adequate supply of gas, than of the price they are charged for it.

The Extensions at the Burnley Gas-Works.—The Gas Committee of the Burnley Corporation have recommended the acceptance by the Council of the tender of Messrs. Clayton, Son, and Co., Limited, of Leeds, for a new gasholder at Stoneyholme—the price to be £4940. The principal contracts in connection with the new sulphate of ammonia works have already been let.

PLYMOUTH AND STONEHOUSE GAS COMPANY'S BILL.

A Meeting of the Plymouth and Stonehouse Gas Company was held last Tuesday—Mr. G. HENDERSON in the chair—to consider the provisions of the Bill which has been deposited in Parliament by the Directors.

The CHAIRMAN, in addressing the shareholders, remarked that the Company were now in their jubilee year; their Act of Parliament having been obtained in the year 1844. He therefore thought it would be desirable and interesting to the shareholders if he gave some details as to the progress made since that date. In 1855 they went to Parliament for power to borrow additional capital. At that period their annual production of gas amounted to 70 million cubic feet, or about 2 millions for every £1000 of capital employed. They again asked Parliament for more capital in 1878, when the quantity of gas produced was 316,000,000 cubic feet; showing they produced twice as much then for every £1000 employed as in 1855. Last year they produced nearly 669,000,000 cubic feet, representing about 5,500,000 feet for every £1000 of capital. In 1878 they carbonized 30,023 tons of coal, which yielded 316,115,000 cubic feet of gas, representing £2 16s. 7d. of capital per ton of coal. Last year they carbonized 60,136 tons of coal, increased the production of gas to nearly 669,000,000 cubic feet, and reduced the capital per ton from £2 16s. 7d. to £1 19s. 10d. It must be obvious to every man of business that the affairs of the Company could not be economically conducted unless the capital was increased from time to time. The point that had prominently occupied the attention of the Directors had been the prevention of unnecessary expenditure of capital; and they had consistently pursued a policy which had resulted in Plymouth occupying the proud position of being able to obtain gas at a lower rate than any other place in the kingdom. They obtained their coals from Newcastle; and notwithstanding freights and cartage—representing £20,000 per annum—the inhabitants of the northern city had to pay more for gas than Plymouth; and last year an increase of 2d. per 1000 cubic feet was made at Newcastle. From the commencement of the Company, the Directors had paid strict attention to the capital expenditure. The larger the capital, the larger was the amount required to pay dividends. They only wanted about one-third of the amount required by other Companies; the figures being 4½d. per 1000 feet, as against 1s. to 1s. 3d. in most instances. Their success was not due to the working in connection with the production of gas; it was simply a question of capital expenditure. The time had now arrived when they must make considerable extensions; and it must be borne in mind that, as the business increased, the extension must be on a larger scale. The additional capital they proposed to raise was £100,000 of 5 per cent. stock, instead of shares; and it was proposed to consolidate the whole of the existing share capital. At the present time they had three classes of capital. There was the original capital, upon which they were entitled to pay 10 per cent., but upon which, by the sliding scale, 12¼ per cent. was paid; additional 7½ per cent. capital, paying 9¾ per cent.; and further 7 per cent. capital, now paying 9¼ per cent. It was desirable to explain how the sliding-scale affected both consumers and shareholders. Their standard price was 2s. 6d. per 1000 feet. In their last Act, they were entitled to pay an additional ¼ per cent. for every penny reduction off the standard rate. As they had reduced it to 1s. 9d., the whole of the capital was entitled to an extra 2¼ per cent. How had that acted with regard to the consumer? Taking the consumption of last year as a basis, he found that the difference between 2s. 6d. and 1s. 9d. had effected a saving of £22,698 per annum. By a reduction of 1d. per 1000 feet, the consumers benefited to the extent of £2522. The shareholders derived £269 on a penny reduction, which gave them an extra ¼ per cent. dividend. Most of the other companies under the sliding-scale obtained one-fifth of the benefits derived by the consumer; whereas they only got about one-tenth. The consolidation of capital into 5 per cent. stock had been adopted with success at Bristol, Oxford, and the Crystal Palace. So far as the shareholders were concerned, they would not be affected, because the sliding-scale would still operate, and the same dividends would be paid.

The SOLICITOR (Mr. J. Shelley) having given a synopsis of the provisions of the Bill,

The CHAIRMAN moved a resolution approving of it.

Mr. SNOW seconded the motion, which was adopted.

This concluded the business.

HARROW DISTRICT GAS COMPANY.

The Half-Yearly General Meeting of this Company was held yesterday week, at the Guildhall Tavern, Gresham Street, E.C.—Mr. JAMES GLAISHER, F.R.S., in the chair.

The ENGINEER and SECRETARY (Mr. J. L. Chapman, Assoc.M.Inst. C.E.) read the notice calling the meeting; and it was agreed to take as read the Directors' report and the accounts, which were briefly referred to in our last issue.

The CHAIRMAN, alluding to the first paragraph in the report—that "the past half year has, by reason of the coal strike, been one of considerable anxiety to the Directors"—said he was sure every one of the proprietors would have shared in that anxiety. It would be in the recollection of the shareholders that, at the last half-yearly meeting, a question was put to him, which he charily answered, as to whether the Directors had taken time by the forelock, and got a good stock of coal in hand. He replied that they had. Little did he think that the coal strike was going to be so long and disastrous in its effects. About that time the Directors had another cause of anxiety in the serious illness of Mr. Chapman. He (the Chairman) recollected distinctly going to Harrow, and leaving it with a heavy heart; for they could not tell him how long their Engineer would be laid aside. Imagine, he remarked, his feelings under such circumstances, with the coal strike then becoming difficult. The consequence was they ran out of coal, and had to buy a supply at any price and of any quality; for such was the position of all gas companies who had to depend solely upon railways, as they had. In addition to this, the fine weather that preceded the strike had lessened their business so much that the receipts for gas in the Michaelmas quarter were nearly £100 short of the corresponding period of 1892. Besides this, the weather was so dry that they, in common with other gas companies whose pipes were laid in clay, felt much inconvenience by the pipes bursting and the gas escaping. He had no doubt the shareholders had noticed that the leakage (which in the second half of 1892 was 834,000 cubic feet) was on this occasion almost 1,500,000 cubic feet—in fact, an increase of 50 per cent. It was 4·3 per cent. in the corresponding period; and 6·7 per cent. in the past half year—the difference, he believed, being wholly and solely in consequence of the breaking of the pipes. As he had already said, in the first quarter they received about £100 less for gas. November proved to be a cold month; and they gained £64 more—the decrease on the half year being £34. They had to pay an extra £330 for coal. But coke improved by £178; tar was also better by £28; and sulphate of ammonia, by £53—making the receipts for residuals £260 more, which went a long way towards recouping the increased price paid for coal. In the half year they made nearly 20 million cubic feet of gas; being 618,000 feet more than in the corresponding six months. Therefore, though he had to tell them the profits were less, the business was increasing—it being less profitable arose from the circumstances he had mentioned. The total result of the working was a profit of £1640, which was a decrease of £43. To make up the amount needed for the dividends, they would have to take £34 out of their small undivided balance. Considering all the circumstances of the half year—the fineness of the weather, the illness of their Engineer, and the dearness and poor quality of the coal (they had only sold about 9000 cubic feet of gas per ton, being less than usual by 400 or 500 feet), he considered the Company had come out very well. He was sure the proprietors would sympathize with Mr. Chapman in his illness, and congratulate him on being as well as he was that day. The Chairman concluded by moving the adoption of the report and accounts.

Mr. C. HORSLEY, J.P., seconded the motion, which was carried.

A resolution was next passed, declaring dividends at the following rates per annum: 7½ per cent. on the original "A" capital, 7 per cent. on the first additional "B" capital, and 5¼ per cent. on the second additional "C" capital, all less income-tax.

The retiring Directors (Mr. C. Horsley and Dr. Glaisher, F.R.S.) were re-elected, as was also the retiring Auditor (Mr. F. G. Fenton).

The Purchase of the Great Stanmore Gas Undertaking.

A Special Meeting was then held for the purpose of considering the Bill which has been deposited in Parliament to empower the Company to acquire the Great Stanmore Gas Company, Limited.

The SOLICITOR (Mr. Bannister), at the request of the Chairman, gave an outline of the provisions of the Bill, which were noticed in the JOURNAL for Jan. 16 last (p. 105).

The CHAIRMAN afterwards remarked that he had frequently wished there had been more go in Harrow; and Stanmore, which was a part of Harrow, abutting close upon their district, appeared to have that which he wanted—there seemed to be a movement constantly going forward there. In his visits to Stanmore, he became very pleased indeed with it; and he came to the conclusion that it would be of considerable benefit to the Company if the gas undertakings were amalgamated. The place was growing fast with good houses and properties; and it would be a promising addition to their district. Under these circumstances, he moved—"That the Bill in Parliament, entitled 'A Bill for confirming an agreement for the acquisition by the Harrow District Gas Company of the undertaking of the Great Stanmore Gas Company, Limited, to extend the limits of supply of the first-mentioned Company, to authorize them to raise additional capital, to confer further powers upon them, to alter their name, and for other purposes,' and now submitted to this meeting in the form in which it is proposed to be introduced into Parliament, be and the same is hereby approved, subject to such alterations as Parliament may think fit to make therein, and the Directors of the two Companies respectively may approve."

Mr. HORSLEY seconded the motion, which was unanimously carried.

The CHAIRMAN then proposed that the thanks of the proprietors be given to their Engineer, and that their congratulations be presented to him on being again with them, they hoped, with renewed strength.

Mr. BAYNES seconded the motion, which was cordially agreed to.

Mr. CHAPMAN thanked the shareholders for this renewed expression of their confidence. He was sorry that he was laid aside during the difficult times through which they had passed; and he added that he believed the amalgamation of the two Companies would tend to the benefit of the shareholders, and still more to that of the consumers.

Mr. A. F. PHILLIPS, in moving a vote of thanks to the Directors, observed that, in his opinion, the proposed amalgamation was a most desirable end to attain; and that he was confident Great Stanmore would increase the value of the Harrow undertaking.

Mr. J. G. BROWNE seconded the motion, which was agreed to.

The CHAIRMAN having replied, the proceedings terminated.

Reduction in the Price of Gas at Rye.—The Directors of the Rye Gas Company have reduced the price of gas from 3s. 4d. to 3s. per 1000 cubic feet for private consumers, and from £3 12s. to £3 7s. per lamp per annum for the public lighting.

The Liverpool Gas Company and the Corporation.—The dispute between the Liverpool Gas Company and the Corporation, relative to the increased price of gas, was further considered by the Corporation Watch Committee at their meeting yesterday week. It will be remembered that the Company declined to exempt the Corporation from liability to pay the increased price, whereupon the Watch Committee passed a resolution recommending the Council not to pay the additional charge until the accounts of the Company had been thoroughly examined by the City Auditor (Mr. R. Barrow). At last week's meeting of the Committee, a letter was read from the Company pointing out that the prices now charged were regulated by the terms of an agreement made between the two bodies in 1860, and that the question of the audit could in no way affect the matter. The Committee took no action upon this letter.

PROVINCIAL GAS AND WATER COMPANIES.

The following paragraphs contain particulars of the working of the Gas and Water Companies mentioned.

Gas Companies.

At the half-yearly meeting of the Brighton and Hove General Gas Company, held on the 2nd inst.—Mr. F. E. Webb in the chair—dividends were declared at the rate of 11½ per cent. per annum on the original ordinary capital, 8½ per cent. per annum on the "A" ordinary capital, and 6 per cent. per annum on the "B" preference capital, all less income-tax, as recommended by the Directors in their report, which was noticed in the JOURNAL for the 27th ult. Mr. J. Birch Paddon and Mr. F. E. Webb were re-elected Directors; and Mr. R. Hesketh Jones, J.P., was re-appointed the Company's Special Auditor. The thanks of the proprietors were accorded to the Chairman and Directors, for their attention to the interests of the Company; as well as to the Manager (Mr. J. Cash, Assoc.M.Inst.C.E.), the Secretary (Mr. W. H. Hardy, F.C.A., F.S.S.), and the other officers, for their attention to the duties of their respective departments.

In the report of the Directors of the Goole Gas and Water Company for the year ending December last, it is stated that, after providing for interest on loans amounting to £447, and the payment in August last of an interim dividend of 4 per cent. (which absorbed £900), there is, including £1632 brought forward from the previous year, a disposable balance of £3184, out of which it is proposed to make a payment to the shareholders which will bring the dividend for the year up to 9 per cent. It is expected the purchase-money will be paid shortly by the Local Board, who have taken over the works.

The 94th half-yearly meeting of the Harrogate Gas Company was held on the 27th ult., under the presidency of Mr. C. Allanson. In their report, the Directors stated that the amount available for division enabled them to propose to pay the statutory dividends, and carry forward the balance. In order to make extensions urgently required, and rendered necessary by the increased demand for gas, some important work had been put in hand, which would necessitate the raising of additional capital. The accounts accompanying the report showed receipts amounting to £24,597, and expenditure to £15,464; leaving a balance of £9133. In the course of his remarks, when moving the adoption of the report, the Chairman gave some particulars as to the development of the undertaking during the past three decades. He said that in 1863 the total quantity of gas made was between 11 and 12 million cubic feet; in the year just closed, nearly 13,000 tons of coal were carbonized, producing upwards of 130 million cubic feet of gas. About the year 1884, the Company introduced the system of letting out on hire gas cooking and heating stoves. This department had been so active that during last year more gas was used for these purposes than was consumed in the whole town for private and public lighting 20 years ago. He particularly named these matters to show that the Company must be prepared, by making all requisite extensions, to meet the demand for gas. The Directors were about to ask authority to raise additional capital, in order to carry out necessary work; and the particulars he had furnished would be evidence that they were not making any unreasonable request. The report was unanimously adopted; and the dividends recommended were declared. The retiring Directors and Auditor having been re-elected, the Secretary (Mr. H. Wilkinson) read the notice convening a special meeting, at which the Directors were authorized to issue £5000 of debenture stock and 1000 new ordinary £10 "C" shares. The proceedings closed with votes of thanks to the Directors, officers, and staff.

The Heckmondwike Gas Company's accounts for the half year ending Dec. 31 last show a total income of £6464, and a balance of profit of £2261. The sum derived from the private gas consumers, after deducting discounts and bad debts, was £4489; and from public lighting, £376. The meter and stove rents amounted to £194; the residual products produced £1303; and a sum of £98 was received by way of dividends from investments. The amount spent on coal was £2055. The balance on the profit and loss account applicable to the payment of an interim dividend is £2997.

At the annual meeting of the Ilfracombe Gas Company last Wednesday, it was reported that the amount available for dividend was £1285; and the Directors recommended the payment of dividends of 10, 7, and 4 per cent. on the "A," "B," and "C" shares respectively, and 1 per cent. arrears of dividend on the "A" shares. The make of gas had increased 808,000 cubic feet, which was considered very satisfactory, with the abnormal weather of the year. In moving the adoption of the report, the Chairman (Mr. T. D. Wivell) said the Directors had not been able to make any reduction in the price of gas as they had desired. They had experienced great difficulty in procuring coal during the year. They trusted principally to Scotch coal; but, owing to the strikes and other causes, they were unable to get any of that coal from September to January last. Although Wales was in sight of Ilfracombe, Newcastle coal could be delivered to them at only 1s. per ton more than the Welsh coal, which was not so good for gas making. The report was unanimously adopted.

In moving the adoption of the report at the half-yearly meeting of the Lewes Gas Company last Wednesday, the Chairman (Mr. J. Broad) said he much regretted that the Directors could not render to the shareholders a more satisfactory balance-sheet than they did that day. Their receipts were increased by the sale of gas something like £100, and the receipts for sulphate of ammonia had also been augmented; but unfortunately they had to set against those advances a very large expenditure on coal. This matter had given some anxiety to the Directors during the past six months. They were led to suppose that they would have had a good increase on the sale of gas. It was true they had a little; but their output from the works was considerably more than the increase shown, as, when they came to compare the figures, they found unfortunately a very serious leakage of gas. The leakage was nearly 10 per cent., whereas it should have been something like 5 per cent. This led them to call upon the Manager to examine the pipes and mains, which had not yet been completed; but in the portion that had been done, they discovered some very serious escapes. This would account to a great extent for their large output of gas; but at the same time it was unsatisfactory to them in the payment of dividend. It appeared that the examination or testing of the pipes and mains had not been done for 14 years; and he trusted that the present examination would prove satisfactory, and not only stop the leakage, but increase the revenue from gas. This unfortunately put them back to a dividend of only 4½ per cent. He was in hopes they would have been able to pay 5 per cent., and add a little to reserve; but owing to the circumstances he had mentioned, they found they could only declare a dividend of 4½ per cent., which was the amount paid in the last two half years. Mr. Miles, in seconding the motion, pointed out that on the profit and loss account, the balance was £1316, which would only give them a dividend of 3⅝ per cent. on the capital of £35,905, while they were going to pay 4½ per cent. This did not seem to him to be a legitimate way of doing business. A serious statement was afterwards made by the Chairman as to the stock of coal. He said that last half year they brought forward 1460 tons of coal; but it was a question whether they had it in stock, and then, of course, the 2600 tons of coal carbonized was made up of the figures brought forward and the 1212 tons of coal received. They were much afraid that the figures were brought forward merely to balance the account, and that the coal was not actually in stock on June 30. It appeared that there were from 400 to 500 tons of coal unaccounted for. The Directors were not at all well satisfied with regard to this matter; and they were investigating it, and doing the best they could. Mr. Lenny, one of the Directors, observed that, if there was not soon some considerable alteration, he must certainly decline to act on the Board. The report was subsequently carried.

The ordinary general meeting of the Londonderry Gaslight Company was held on the 2nd inst.—Mr. R. W. Newton, J.P., in the chair. The Secretary and Manager (Mr. J Macnie, Assoc.M.Inst.C.E.) having read the notice convening the meeting, the report and accounts were presented. The latter showed that the revenue amounted to £15,728, and the expenditure, to £11,272; leaving a net profit available for division of £4456 on the year's working. The Directors recommended that out of this sum a dividend at the rate of 10 per cent., free of income-tax, should be declared, and the surplus carried forward. The Chairman, in moving the adoption of the report, stated that, as there was a good stock of coal on the works at the commencement of the recent coal strike, the Directors were not so much inconvenienced as many others were, or put to so much expense. One result of the scarcity of coal was to relieve the Company of a considerable accumulation of coke, at a moderate price. The demand thus created still continued. Tar, however, which two years ago was sold at the rate of 30s. per ton, now only brought 8s. per ton, with little prospect of improving. The Deputy-Chairman (Mr. Tillie) seconded the motion; and it was carried. The retiring Directors and Auditor having been re-elected, a vote of thanks was accorded to the Directors and to Mr. Macnie for the way in which they had conducted the business.

The annual meeting of the Rugby Gas Company was held on the 28th ult., when it was reported by the Directors that the receipts on revenue account for the year amounted to £12,711; and the expenditure, to £8193—leaving a balance of £4519 to be carried to the profit and loss account. This, after deducting the interim dividend (£1644), added to £2983—the net balance, after payment of the dividend for the half year ending Dec. 31, 1892—with £47 interest on monies deposited, less £297 interest on mortgages, and £750 carried to capital account for depreciation in respect of the old gasholder, formed a net balance of £4856. The Directors recommended a dividend for the past half year at the rate of 11 per cent. per annum; making, with the interim dividend, 11 per cent. for the year. Considerable anxiety was experienced by the Directors during the late coal strike; but they were fortunately able to make arrangements for coal which proved satisfactory.

In the report to be presented to the shareholders of the Sheppy Gas Company at their meeting to-morrow, the Directors state that, in consequence of the exceptionally fine weather last year, there was a falling off in the consumption of gas, which was slightly less than the quantity sent out in 1892. Penny-in-the-slot meters have been introduced by way of experiment; and they promise to become popular among the Company's smaller consumers. The receipts amounted to £9964; the expenditure, to £6964—leaving £3000 to be carried to the profit and loss account. The amount available for division is £1771; and the Directors recommend the declaration of the maximum dividends—making 4, 10, and 7 per cent. per annum.

The accounts of the South Bank and Normanby Gas Company for last year showed receipts on the revenue account amounting to £6065, and an expenditure of £3423. The sum available for distribution (with £100 taken from the reserve fund) was £2742. Of this £1032 was used in paying an interim dividend; £1622 was required for a dividend at the rate of 5½ per cent. for the half year; £52 went towards extinguishing the suspense account; and £25 to meet bad debts.

The ordinary general meeting of the South-East Essex Gas and Water Company, Limited, was held on Monday last week—Mr. A. G. Nutt presiding. In moving the adoption of the report, the Chairman said the gentleman who promoted the Company and who guaranteed the capital (Mr. F. Pope) was at present in the Bankruptcy Court; so that they were face to face with a fine property and no funds to carry it on. They had, however, obtained an Act of Parliament to supply water; but they wanted money to lay down the mains. The moment these were down, they would be able to draw a fair sum for water-rentals. The shareholders had been called together for the purpose of asking them to raise the necessary capital to carry on the undertaking. Their creditors had met them very fairly, and had offered to take deferred shares for the amount they owed to them. The capital the Directors proposed to ask the authority of the shareholders to raise was nominally £5000; but they did not expect or want so much as this. All they required was sufficient to lay down the mains. Dr. Orme stated that the population of the district of Leigh had considerably increased of late years; and he believed the Company's water-rentals would be sufficient to pay from 5 to 9 per cent. on the capital. A number of questions were put by Mr. Bartlett, in reply to which the Chairman stated that, out of the capital of £1531 subscribed, £700 had been paid for obtaining the Act of Parliament. They had paid £2000 to the promoter; the additional amount having

been raised by bills. This payment had been sanctioned by a resolution of the old Directors. There were calls unpaid to the amount of £113. Mr. Bartlett asked what there was to show for the capital put into the concern. The Chairman replied that they had an Act of Parliament. Mr. Bartlett said he saw by the last accounts that there was an item of "Land acquired, including law charges, £385;" and he would like to know how this was made up. The Chairman said they had bought land at Benfleet, for which they paid a deposit of £10, and also some at Rayleigh, for which £110 was paid, to sink a well. After some discussion, the Chairman stated that the desire of the Directors was to save the property, which they could do if the shareholders would subscribe more capital. If this were not done, the Company would have to be wound up. The amount owing to their creditors was about £1100, for which they were willing to accept second preference shares. The Company had the option of purchasing a well from Mr. Hales for £1000 less than they would have to pay the contractors for it. Mr. Hales stated that he would be willing to sell his well to the Company for £3000, £750 of which he would take in cash. On the motion of Mr. Bartlett, a resolution was passed appointing a Committee of shareholders to inquire into the expenditure of the share capital of the Company, to ascertain what were the present assets, and to report to a meeting to be held in a month's time. An extraordinary general meeting was then held, at which resolutions were passed authorizing the Directors to raise £5000 on "A" preference shares, to carry a preferential dividend of 5 per cent. per annum, and to issue £1100 "B" preference shares, to rank for 5 per cent. after the dividend had been paid on the "A" preference shares; and also approving of an agreement between the Company and Mr. Hales to purchase his well for £3000.

The half-yearly meeting of the Thirsk Gas Company was held at Hull, on the 28th ult. The report presented stated that the net profit for the year was £704; and the profit and loss account, after being charged with the interest on the mortgage loan and the interim dividend, showed a balance of £392 available for dividend. Out of this the Directors recommended a dividend of 3½ per cent. for the half year ending Dec. 31 last, making with the interim payment 6½ per cent. for the year. The report was adopted.

Water Companies.

The receipts of the Leatherhead and District Water Company for the half year ending Dec. 31 last amounted to £1236; and after allowing for the expenses incurred, a profit of £523 remained. Adding to this the £266 brought forward, made £790 available for dividends and the interest on the debentures. A dividend has been declared at the rate of 3 per cent., as against 2½ per cent.—leaving £300 in hand.

At the ordinary general meeting of the South Essex Water-Works Company on the 24th ult., Mr. W. C. Fooks, Q.C., in moving the adoption of the report, congratulated the shareholders on the continued improvement in the position of the Company. He said that the Directors proposed to set aside £1000 to depreciation and contingency account, which he was sure the shareholders would consider was a proper precautionary measure to adopt. The works had been maintained in an efficient condition. Although the revenue had increased as compared with the corresponding half of 1892, there had been no increase in the working charges. He had no reason to doubt that the progress of the Company would continue. Mr. J. C. Amos, who seconded the motion, said the time had arrived to increase the reservoir accommodation at Aveley; and, in order to meet the necessary expenditure to be incurred in carrying out the work and in the extensions of mains, the Directors proposed shortly to issue capital to an amount not exceeding £5000. After a brief discussion, the report was adopted, and dividends were declared at the rate of 5 per cent. on the preference stock, and at the rates of £4 and £2 12s. 6d. per cent. on the ordinary stock. Mr. A. Smee and Mr. J. C. Amos (the retiring Directors) were re-elected; and Mr. W. S. Cliff was re-appointed Auditor. A vote of thanks was accorded to the Chairman and Directors, and the proceedings closed.

BELFAST CORPORATION GAS-WORKS.

New Purifying Plant.

For the past two years, the subject of supplementing the existing purifying plant at the Belfast Corporation Gas-Works has been from time to time discussed by the Gas Committee; and now the Engineer (Mr. James Stelfox) has submitted to them a scheme for its extension which has occupied much time and thought in devising, owing mainly to the congested state of the works. It provides for four sets of purifiers (four in each set); the size of each box being 33 ft. 6 in. by 20 ft. The existing purifiers consist of three sets, in which each box is 20 feet square, and two sets in the old section of the works 18 feet square. He estimates that the new purifiers, with the three sets in the new section, will be sufficient to purify all the gas the present works can produce, including also that which will be made in the new retort-house and water-gas plant. The purifiers in the old section will then be available in case it should be considered desirable to arrange for an extension of the carburetted water-gas system. He calculates the cost of the proposed works, including foundations, connections, hoists, and gear, at about £20,000. The matter came before the Corporation at their last monthly meeting, when Alderman Connor, M.P., in moving the adoption of the report, said the Committee recommended the extension of the purification plant as proposed. For want of ground, they had been advised to adopt a sort of two-storied system of purifiers; and although they were a little more expensive than they would have been if they had been constructed on the ground, the additional cost was not great. The extra plant would be very necessary for the supply of gas next winter. Alderman Dixon having seconded the motion, Mr. Masterson said they were formerly in the habit of receiving a considerable sum for certain purposes out of the profits of the Gas Department; and, as matters stood, if this large outlay took place, and there was expenditure on the electric light undertaking, he wanted to know if it was at all likely from past experience that they would be able to make ends meet between the Gas Committee and the Electric Light Committee. In reply, Alderman Connor said the money proposed to be expended in the extension of the plant at the gas-works would be borrowed, and would not come out of income; and he thought the electric light expenditure would be of the same character. He regretted to have to make the statement that, in consequence of the coal strike and the high price of coal, the Gas Department would not show the satisfactory results this year to which they had been accustomed. He was afraid the loss would come to £18,000 or £20,000. He did not say, however, that ends would not meet. The motion was adopted.

ROTHERHAM CORPORATION GAS-WORKS.

The Salary of the Engineer.

For between two and three hours last Wednesday, the Rotherham Corporation were occupied in discussing a recommendation of the Gas Committee that the salary of their Engineer (Mr. C. B. Newton) should be raised by £100 per annum. The adoption of the recommendation was moved by Mr. Stoddart, who asked the members to judge Mr. Newton by the work he had done since he took charge of the gas-works. There was no question about his ability if they looked at the gasholder which had been erected under his supervision. They had been told that the first gale of wind would blow it into the river; but it had stood the recent gales without the slightest strain. The capacity of the holder was originally 450,000 cubic feet, and cost £11,500. The extensions had cost only £6900, and had given an additional capacity of 550,000 cubic feet. With regard to Mr. Newton's ability as a gas maker, he had realized 10,067 cubic feet of gas per ton of coal carbonized; whereas the highest production during the last six years had been 9600 feet. He had actually effected a saving of £736 in the cost of coal last year. Further, the plant was in a most wretched condition when Mr. Newton became Manager of the works; and he had already put it into first-class order. He (Mr. Stoddart) had been at some trouble to ascertain what had been the profits of the gas-works. Profits depended on three things—the price of coal, the amount of wages paid, and the receipts for residuals. He proceeded to give statistics, claiming that for the year 1893 if Mr. Newton had not been the Manager of the gas-works, instead of there being a profit, they would have lost about £1500. During Mr. Newton's time, they had made the largest profits of any period within the last six years, leaving out the question of the price of coal. In 1893 the gross profits were £6806; and in 1892, £6158. Mr. Marriott seconded the motion, after which Mr. Hirst moved an amendment that the recommendation be referred back to the Committee; contending that the Council should wait until March 25 to see what were the results of the year's working. He also remarked that Mr. Stoddart appeared to have forgotten that between 1874 and 1892, the Gas Department divided from the profits a sum of £45,504 among the other departments to keep down the rates. The amendment was eventually rejected; and the resolution was carried. Mr. Sorsby, however, expressed his intention of putting a notice to rescind it on the *agenda* for a future meeting.

SMETHWICK LOCAL BOARD GAS SUPPLY.

A Satisfactory Report.

At the Meeting of the Smethwick Local Board last Friday—the report and statement of accounts in connection with the Gas Department for the year ending Dec. 31 last, prepared by the Secretary (Mr. W. J. Sturges) were submitted. In the course of his report, Mr. Sturges stated that the total outlay on capital account, in connection with the gas undertaking, at the close of the past year was £168,028; leaving an unexpended balance of £1352. The net income from the sale of gas increased last year by £459; the quantity of gas consumed being 154,571,400 cubic feet, or 2,282,600 cubic feet more than in 1892. This was an advance at the rate of 1½ per cent., as compared with 4·7 per cent. in the preceding twelve months. There were 44 additional cooking-stoves fixed; making the total number out on hire 140. There was a falling off in the receipts for residuals. Coke realized £4299, against £4857 in 1892, and £6053 in 1891—no coke being used for fuel purposes in the latter year. During the past year, 1650 tons, of the value of £907, were used for firing the retorts. There was less coke produced, owing to the smaller quantity of coal carbonized—viz., 819 tons, representing about 500 tons of coke. Tar and liquor yielded £65 less than in the previous year, due in both instances to the reduced quantity of coal carbonized—equal to 9385 gallons of tar and 26,265 gallons of liquor—and a slightly smaller yield of liquor per ton of coal. The profit on gas-fittings was £59, as against £52 in 1892. The total income from all sources amounted to £26,749, compared with £26,905 in 1892—a decrease of £156. The total cost of manufacture during the year was £14,039, compared with £15,891 in 1892. The charge for coals was less by £364, although the cost per ton was higher—viz., 13s. 6·677d., against 13s. 3·789d. in 1892. The quantity carbonized was 15,000 tons, yielding 164,922,000 cubic feet of gas, or 10,995 feet per ton, as against 15,819 tons, yielding 161,953,000 cubic feet, or 10,238 feet per ton, in 1892. In other words, 2,969,060 cubic feet more gas were produced, while 819 tons less coal were used. No slack is now used for heating the retorts—coke only being employed. The quantity used as fuel last year was estimated at 1650 tons—equal, at 11s. per ton, to £907. As the cost of slack in 1892 was £852, *plus* £551 the value of the coke, or a total of £1403 for fuel, there was a saving of about £500 in this respect. The cost of purification was greater last year by about £60 than in 1892; but there was a saving of £226 on wages for carbonizing. The cost per ton of coal was 2s. 9·55d., compared with 2s. 11·25d. in 1892, and 3s. 1·46d. in 1891. The expenditure on repairs of works was much less last year than in 1892—viz., £1013 as against £1484—owing to there being no charges incurred for repairs and renewals of retorts. There was an increase of £59 in the cost of distribution, and of £70 in the public lighting account. The total expenditure for the year was £17,054, compared with £18,833 in 1892—a decrease of £1779. The gross profit was £9695, compared with

£8072—an increase of £1623. After meeting the charges for interest, &c., there was a surplus of £1678, or £1278 if a reserve of £400 was made for renewal of retorts, as recommended by Mr. Sturges. There would then stand at the credit of the profit and loss account a balance of £2858, out of which must come the final instalment of £1365, leaving £1493 to go towards extinguishing the sum of £3848 now standing as an asset in the balance-sheet—being part of the cost of regenerative plant not chargeable to capital account. The sinking fund amounted at the close of the year to £11,542. At the end of the report was a statement showing the saving in the cost of manufacturing gas in 1893, compared with the cost of making the same quantity of gas on the basis of the working of 1891. This showed a total of £1478; and there were increased charges for interest and sinking fund on new loans, as well as a considerable amount expended for alterations of the retort-house beyond that sanctioned to be borrowed.

Mr. J. Brookes, the Chairman of the Gas Committee, in moving the adoption of the report, said that about two and a half years ago the Manager (Mr. B. W. Smith) represented to the Committee that the productive power of the works would have to be increased to meet the growing demand for gas; and on his advice the retort-house was fitted up with retorts on the regenerative system. He estimated that the house would take sufficient retorts on this system to last for twenty years; and that a saving of at least £1000 a year would be effected. After a full year's working, this estimate had been amply borne out. The Committee obtained permission to borrow £6292 for the purpose of carrying out all the various extensions absolutely required. The remodelling of the retort-house caused an outlay of £6433, of which the Committee had permission to borrow only £2592—the difference being regarded merely as a replacement. The balance of £3841 was consequently charged to the revenue account. The alterations were commenced in May, 1892; and the first section of the new retorts was brought into operation on Sept. 13 in that year—the remainder being completed by the end of March, 1893. As showing the advantage of the new system, he might state that in 1891 (the last year's working under the old plan) the net profit realized was only £192; whereas in 1892, with the new system in operation for three months only, the profit was slightly larger—being £453. Had they worked throughout the whole of that year on the old system, the profit would have been only £55. The year 1893 had given a full year's test of the new system; and the result had been a net profit of £1678, about £1500 of which was entirely due to the improved method of working. Had the prices of residuals been maintained, and the cost of coal been the same as in 1891, there would have been an additional net balance of nearly £1000 for the year. As further evidence of the advantage of the new system, the lowest price paid for coal was in 1888, when the net profit was £971, after providing £7877 for interest and sinking fund. In 1893 coal cost 38½ per cent. more, and stokers' wages 20 per cent. more, while residuals rose only 14 per cent.; and after paying £8016 for interest and sinking fund, they had a net profit of £1678, and yet the price charged for gas was only the same as in 1888. In dealing with the profits, the Committee deemed it wise to reserve £400 for the renewals of retorts. The balance, together with a small amount of profits in hand, they recommended should be placed to the credit of the regenerative plant account; and they hoped that, in the course of two or three years, this amount might be paid off out of profits. The Committee were glad to state that they did not suffer any inconvenience during the long coal strike. They fortunately held a large stock of coal, which just carried them through the trying times; otherwise the consequences would have been disastrous. As it was, no alteration had been made in the price of gas; and they trusted they would not find it necessary to make any.

The report was adopted.

OLDBURY LOCAL BOARD GAS SUPPLY.

The Annual Accounts.

At the Meeting of the Oldbury Local Board on the 2nd inst., the accounts of the Gas Department for the year ending Dec. 31 last were presented. They showed that the amount of the loans outstanding on that date was £71,261, out of £79,199 borrowed; the difference (£7938) having been repaid. The total expenditure up to the close of the year was £76,412; £200 having been laid out for new meters, mains, and services in the past twelve months. The amount received for gas was £9522; for residuals, £3013; and for gas-fittings, £122—the total receipts being £12,693. The outlay for coals amounted to £4946; the total manufacturing charges, to £6765; and the total expenditure, to £8188—leaving a gross profit of £4505. After meeting interest and repaying £1034 of loans, the net profit was £952. The working statement, which was signed by the General Manager (Mr. A. Cooke) showed that 6469 tons 4 cwt. of raw material was carbonized, and 1240 tons 8 cwt. employed for firing. The residual products were: Coke, 3981 tons; breeze, 178 tons 8 cwt.; tar, 88,110 gallons; and ammoniacal liquor, 173,698 gallons. The total make of gas was 70,529,000 cubic feet, or at the rate of 10,902 cubic feet per ton; the quantity sold being 68,021,000 cubic feet, or at the rate of 10,514 cubic feet per ton. With regard to residuals, the make of coke per ton was 12 cwt. 3 qrs.; of breeze, 2 qrs.; of tar, 13·6 gallons; of ammoniacal liquor, 26·8 gallons. The residuals realized 9s. 3·55d. per ton of coal carbonized. In moving the adoption of the accounts, the Chairman of the Gas Committee (Mr. J. W. Wilson) congratulated the Board and the ratepayers on the satisfactory year's working of the Gas Department. He said that, in spite of the great coal strike which had severely affected many of their neighbours, they had passed through it without much loss, and had been able to show a net profit of £952, which had exceeded any previous profit since the commencement of the undertaking ten years ago. In the manufacture of gas there had been an increase of £338, which was attributed to the high price of coal in consequence of the strike. The total expenditure during the year was £8188, compared with £7815 last year. There had been a very large augmentation in the sale of gas; and during the past two years it had increased by 7½ millions. The residuals had proved very profitable articles; there being an increase of £500 on the sales. Had they been a trading concern, they would be able to declare a dividend of 5¾ per cent. In the future, they would have to consider the question of providing retort-houses, and also a better system of heating on the regenerative principle. Mr. Wilson complimented the Manager on the excellent results he had produced. Mr. Smith expressed the feeling of the Board that the Chairman of the Committee himself had no small share in the year's success; and he thought the town was favoured in having so able a commercial man at the head of the gas undertaking. The accounts were passed.

THE ACQUISITION OF THE WOKINGHAM GAS-WORKS BY THE TOWN COUNCIL.

Local Government Board Inquiry.

On the 28th ult., Mr. R. Walton conducted an inquiry at Wokingham, on behalf of the Local Government Board, respecting a memorial from the Corporation praying that a Provisional Order might be issued, giving them power to acquire the local gas undertaking. This matter has been on the *tapis* for several years past, and has been the subject of discussion at many meetings of the Council. In addressing the Inspector, the Town Clerk (Mr. J. May) first gave some statistics relating to the town. He stated that at the 1891 census the population of Wokingham was 3254; but since that time it had increased, until it now approached 3500. The annual assessable value was £12,421; the assessment value to the general district rate being £9418. Proceeding to explain the reason for the application, he remarked that it was the outcome of years of important discussions in the Council Chamber, where it was first mooted in 1885. In 1892 a Committee was appointed to consider the question; and they recommended that the town should be lighted with gas. It was ascertained that the Gas Company would sell the undertaking for the sum of £8160. But as the Corporation considered that figure too high, the Company had entered into an agreement with them for the valuation of the works by competent experts; and up to the present time, no formal objection had been raised to the scheme. The valuation of the works was now in progress; and the result would soon be known. All the statutory requirements had been complied with. Interrogated by the Inspector, the Town Clerk said he was not aware of any special reason why the Corporation wished to purchase the works; but they were perfectly unanimous on the subject. As to the proposed maximum charge for gas, he believed it was either 6s. or 5s. 6d. per 1000 cubic feet. The Inspector intimated that he did not think the Local Government Board would sanction such a high figure; and he inquired what the probable average charge would be. To this the Town Clerk replied that he was not prepared to give an opinion. Mr. J. F. Sargeant, representing the Gas Company, stated that the charge had been 5s. for many years; and that the average price paid for coal was about 22s. per ton. Alderman Heron stated that the object of the Corporation in acquiring the gas-works was to provide gas of good quality, without making an unreasonable profit from it. The Inspector again pressed for some information as to the probable charge; but, on behalf of the Corporation, it was pointed out that they could not bind themselves until they knew what they would have to pay for the works. There was no other opposition.

The Warrington Gas Committee and Prepayment Meters.—Before adopting "penny-in-the-slot" meters for the use of general consumers, the Warrington Gas Committee decided to give them an experimental trial in the cottages of their workmen. The result is so satisfactory that the Committee have now resolved to fix the meters in the houses of all applicants for their use. Where gas-fittings are already in a house, the Committee will provide the new meter, and supply gas at 25 cubic feet for 1d., which is at about the price charged to ordinary consumers, who pay 3s. per 1000 cubic feet, *plus* meter-rent. In cases where fittings are not supplied, the Committee will put in a meter service and a small boiling-burner, and supply gas at the rate of 20 cubic feet for 1d., or 4s. 2d. per 1000 cubic feet. The Committee retain the right to remove the fittings where necessary.

The Agitation for Cheaper Gas in North London.—A public meeting, convened by the Gas Consumers' Protection League (of which Mr. J. Rowlands, M.P., is President), was held last Wednesday, at the Victoria Hall, Victoria Park, to protest against the charges made by The Gaslight and Coke Company. The chair was occupied by Mr. G. Howell, M.P., who condemned the action of the Company in imposing a much higher rate for gas than the South Metropolitan Company. He said the consumers of gas should combine to see that they had a good, abundant, and cheap supply, and, if necessary, appeal to Parliament to assist them in their efforts. Mr. J. B. Jones moved—"That this meeting of gas consumers, supplied by The Gaslight and Coke Company, protests against the high charge of that Company for gas compared with other companies, and is of opinion that a Parliamentary Committee should be appointed to inquire into the present condition of the gas supply of London, with a view to legislation in the direction of securing a reduced and uniform rate of charge, the free use of meters, and a further diminution in the statutory rate of dividends." Mr. T. H. Rippin, in seconding the motion, said he considered the way to meet the Company, if they persisted in their charge of 3s. 1d. per 1000 cubic feet, was to introduce the electric light; and he hoped the Bethnal Green Vestry would take this matter in hand. Mr. Rowlands, in supporting the resolution, said there ought to be one uniform price of gas throughout the whole of the Metropolis; and if the Company could make their business pay in the City, where they did not charge for meters, the meter-rent in the whole area supplied by them should be abolished. The ratepayers were largely interested in securing a uniform price for gas; and the time had come when there should be a full parliamentary inquiry into the whole matter. Mr. Pickersgill, M.P., also supported the motion, which was carried with acclamation; and it was resolved to send a copy of it to the President of the Board of Trade, and a memorial to the London County Council.

MUNICIPAL CORPORATIONS AND THE LONDON COUNTY COUNCIL (WATER) BILL.

At the Annual Meeting of the Association of Municipal Corporations, held in the Council Chamber, Guildhall, last Saturday, under the presidency of Sir A. K. ROLLIT, M.P., the London County Council (Water) Bill was discussed.

Mr. J. H. ELLIS (Town Clerk of Plymouth) moved—"That the general roving power proposed to be conferred by this Bill upon the London County Council may injuriously affect the water supply of towns, and should be opposed; and that it be referred to the Council to take such steps in relation thereto as they may deem advisable." He said that the Bill in question was a most mischievous one, and one which the Corporations ought not to allow to pass. It was to enable the London County Council to take by agreement any lands or easements, wherever they might be, for water purposes. It seemed to him that it would affect them all, whether they were owners of water undertakings or not; unless, indeed, they were like Manchester and Liverpool, who had rightly taken the precaution to purchase their own watersheds. To his mind it was desirable that the Corporations should own their watersheds; and he was fortified in this opinion by one of the greatest water engineers of the century. The effect of the Bill would be that the London County Council could acquire any watershed, even though a town might have its supply from that watershed, unless the town itself owned the fee-simple of it. The Bill had most far-reaching consequences. He submitted that it was contrary altogether to the practice of Parliament to allow a corporation to acquire by agreement land of unlimited extent. The practice with respect to land to be taken by compulsion, as everybody knew, was very carefully guarded by Parliament. But here it would be possible for the London County Council to confine any part of the fells of Cumberland, or Dartmoor, or Exmoor, or any other great place, and then go to Parliament with merely a Works Bill. What would then be the position of the municipalities? There would be difficult questions of *locus standi* that might arise. It might be said that Parliament had authorized the purchase of this area for works, and that it did not affect them, and therefore no *locus* would be granted. Roving powers of this kind were contrary to the practice of Parliament, and moreover were unfair. They should be strenuously resisted by the Association; and he hoped that they would all be unanimous on the question. He was aware that the petition for the Bill had not passed the Examiner on Standing Orders; but the Secretary of the Association (Mr. Pritchard) had asked the promoters whether or not they intended to proceed with it, and he was unable to get any definite reply. Unless they had a satisfactory declaration that the promoters were not going to proceed with their Bill, the Association should be unanimous on the matter, and throw their whole weight against so unprecedented a measure.*

Mr. G. R. SHORTO (Town Clerk of Exeter), in seconding the motion, said the question before them was interesting to his city as well as to other parts of the kingdom, and was generally of very considerable importance. A matter of this kind should not be allowed to proceed without full inquiry. He thought that a mere reference to the Council would be sufficient to effect their object.

Mr. R. H. DAWE (Town Clerk of Hull) said that, following the suggestion of the last speaker, he would ask whether the Town Clerk of Plymouth would allow the omission of four words of the resolution —viz., "and should be opposed." It would confer upon the Council of the Association full power to oppose, if necessary, and afford all the protection that was required. It was rather a strong measure to ask the Association to oppose a Bill, no matter how it might be modified, or whatever might be done, when the details of the scheme were not before them. They had often rejected resolutions of this kind; and they had been referred to the Council with full powers to take any steps they thought advisable. He gathered that the last speaker's view rather leant this way; and he thought it would be preferable.

The suggestion was regarded as a valuable one; and it was accepted. The motion, as amended, was then put, and unanimously adopted.

ST. PETERSBURG NEW WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. W. T. WESTERN in the chair.

The SECRETARY (Mr. F. Grant) read the notice convening the meeting; and the Directors' report and the accounts, which were summarized last week, were then presented.

The CHAIRMAN remarked that when the shareholders met together last year, the Directors told them they had signed a contract to transfer the works to the Municipality of St. Petersburg. They had not then been able to finally adjust their accounts with the town. That was a matter which took some time—much longer, indeed, than the Board anticipated. No less than three separate Committees of the Municipality sat one after the other to examine the accounts; and the result of their investigations was shown by the figures contained in the present report. They fixed finally, without any further question, the annuity which was to be paid to the Company at the sum of 166,601 roubles, payable in half-yearly instalments on July 13 and Jan. 13. The annuity for the past year was punctually paid; and they need have no fear that it would be paid in the future with equal punctuality. The sums already received had been used for paying off bonds, which the Directors thought was the most useful purpose to which they could apply it. Immediately on the signing of the contract, the Board gave notice to their officials in St. Petersburg to dismiss the staff, and reduce the expenses as promptly and as far as they could; but, owing to the length of time occupied in the verification of the accounts, it was not until December that they were able to finally dispense with the services of their Manager. From Jan. 1 last, the usual expenses in Russia entirely ceased; but they had made arrangements by which the late Manager would act as the Company's agent there, and look after their interests, for the very nominal fee of £50 a year. They had also made arrangements by which their London salaries and expenses would probably be covered by about £200 a year. As to the re-arrangement of the capital, the sum which the Directors had set down in the balance-sheet as the value of the annuity was the exact amount the Municipality would have to pay the Company if they redeemed the annuity. That sum, deducting the amount which they set aside as sinking fund, would leave the assets of the Company at, as near as possible, £12 10s. per share—that was the figure which the shareholders might reckon to get if the town paid them off in three months' time, or if they let it run out the full term of 23 years. The present sterling value of each share was rather over £12 10s. The shareholders were no doubt aware of the well-known rule of law which prevented the Directors paying a dividend on the shares until the assets were made equal to the sum stated on the capital account; and there were only two ways of doing this. One was they could accumulate their surplus earnings (which were something like £4000 a year, after paying the interest on the sinking fund) until they had wiped off the debit balance; or they could bring the capital down to the value of the assets. The latter was probably the one which the shareholders would think the most convenient. Assuming that they thought proper to do this, the Company would have property worth the sum stated in the balance-sheet—about £12 10s. per share; and they would have an income upon that which would suffice to pay the interest on the bonded indebtedness, to pay the sinking fund to replace the share capital, and leave a dividend of about 8s. per share, subject to addition or reduction according as the exchange went up or down. He concluded by moving the adoption of the report and accounts.

Mr. R. S. GUINNESS seconded the motion.

The CHAIRMAN, replying to Dr. Magrath, said the 6 and 7 per cent. debentures were issued under the authority adopted in 1880. It was arranged that the 6 per cent. debentures could be paid off at the option of the Company in four years' time *en bloc*, or at any time before that out of the sinking fund, by giving three months' notice. Under that authority, the Directors had already paid off £10,000, and were about to pay off another £5000. The 6 per cent. stock had a prior claim to be paid off before the 7 per cent. They had no right to pay the latter off *en bloc*; it could only be done by applying the sinking fund to it. The annuity ran up to May, 1917; and the sinking fund was sufficient to redeem the capital in 23 years, so as to leave the capital intact.

The motion was carried.

Resolutions were then passed, re-electing the Directors retiring by rotation (Lord E. S. Churchill and Mr. R. S. Guinness) and the Auditors (Messrs. Cooper Bros. and Co.), and fixing the future remuneration of the Directors at £250 per annum.

Mr. MACRAE next proposed a resolution to the effect that £1000 be paid to Mr. Western, in recognition of his services to the Company, more especially in connection with the transfer of the undertaking to the Municipality. He supported his proposal by showing that it was mainly owing to the personal exertions of the Chairman that the Company had been able to live on and struggle through bad times, until now the shareholders would see a substantial return of the capital which they invested in the concern.

Mr. SIDNEY JONES seconded the motion, which, after considerable discussion, was carried, with only one dissentient.

A meeting of the holders of "B" debenture stock was then held, at which the following special resolutions were approved: (1) "That the capital of the Company be reduced from £200,000, divided into 10,000 shares of £20 each, to £125,000, divided into 10,000 shares of £12 10s. each, and that such reduction be effected by cancelling capital which has been lost, or is unrepresented by available assets, to the extent of £7 10s. per share upon each of the 10,000 shares which have been issued and are now outstanding, and by reducing the nominal amount of all the shares in the Company's capital from £20 to £12 10s. per share." (2) "That the Articles of Association be altered by inserting the following article after 112—viz., 112A. 'The Directors may also pay dividends half-yearly out of any periodical payments received from the Municipality of St. Petersburg, so far as they may be applicable for distribution as net profits.'" At a subsequent extraordinary meeting of the shareholders, on the first resolution being submitted for adoption, 17 voted for, and 6 against it; but as it was a special resolution altering the Articles of Association, and three-fourths of the members present did not vote in its favour, it was lost. The second resolution was consequently not submitted.

The proceedings then terminated.

* It will be seen by our article on "Water and Sanitary Affairs" that the County Council are advised not to abandon their Bill.—ED. J.G.L.

Oswestry Water Supply.—It was reported at the meeting of the Oswestry Town Council yesterday week that the Local Government Board had sanctioned a loan of £1890 for the construction of waterworks, instead of £2250 asked for.

The Finances of the Brighton Electric Lighting Department.—The statement of accounts of the Electric Lighting Department for 1893 were submitted at the last meeting of the Brighton Town Council by Alderman Moon, who said the result of the working had been very much what the Committee predicted it would be. The amount carried to the net revenue account was £4011, out of which there had to be paid as interest on redeemable stock £2058, and the amount transferred to loans fund and accrued due to date was £1653; leaving a balance of £300 to be carried to net revenue. This, as a result of the second whole year's working, was not, he thought, unsatisfactory. At the end of 1892, they had a small balance of £12, which had now grown to £300, and this after making a provision of £158 to be carried to the next accounts to provide for bad debts. Considering the fact that last year the Council determined to reduce the price to one-half after a certain number of hours' consumption, this was not an unsatisfactory result; and if it had not been for the reduction of price, they would have had £800 more than they had to carry to net revenue. The number of houses connected with the system in 1892 was 215, and that figure had since been nearly doubled—being now 423. The total number of units sold in 1892 was 156,048; and in 1893, 286,895. Thus it would be seen that the business was progressing; and so far as they had gone in 1894, they were doing rather more in proportion than in 1893.

ROTHERHAM CORPORATION WATER SUPPLY.

Mr. Mansergh and the Dalton Reservoir—A Suggested New Source of Supply.

At last Wednesday's meeting of the Rotherham Town Council, Mr. Hirst requested, in the interests of the Water Committee, that a letter which had that morning been received from Mr. Mansergh should be read. The Town Clerk read the letter, which referred to the construction of the Dalton reservoir; and in it Mr. Mansergh stated that he had examined the plans which had been prepared by Mr. C. B. Newton, and, after carefully considering the whole scheme, and the responsibility which he (Mr. Mansergh) would be assuming if he undertook to report as desired, he asked the Committee to be good enough to allow him to retire from further connection with the business. After this Mr. Hirst said he wished to move—"That the Chairman of the Water Committee and the Engineer have power to make a boring and analyze the water obtained through the red sandstone strata in the neighbourhood of Canklow, and report to the Council without delay." His idea was that they could thereby save an expenditure of £60,000 at Dalton. He would not make such a statement on his own knowledge and experience; but he had had a conversation with an eminent Engineer, Mr. C. E. Rhodes, who had lately sunk a pit at Canklow. Mr. Rhodes had said there was sufficient water in the red sandstone at Canklow to supply the whole of Rotherham, and that they could obtain it at a depth of about 50 yards. The water had been analyzed by Mr. Allen, of Sheffield; and he had pronounced it most excellent for drinking and domestic purposes. There could, Mr. Hirst thought, be no harm in spending a few pounds in making a borehole, and inquiring as to the cost of the erection of a pumping-station, and submitting an alternative scheme to the Council. If the idea was successful, it would mean the expenditure of not more than £10,000 in the erection of engine, boilers, and machinery at a pumping-station, as compared with an expenditure of £60,000, the Engineer's estimate of the cost of constructing a reservoir at Dalton. Alderman Neill seconded the motion, believing there was a great deal in what Mr. Hirst had suggested. Alderman Woodhouse said the subject was discussed at the time the pit was sunk at Canklow; and it was shown that there could not possibly be a continuous supply. The Corporation had, on the other hand, purchased the land at Dalton; and, he argued, they were bound to use it for the purposes of a reservoir. If the land was sold again, they would not get 25 per cent. of the price they paid for it. He objected to the Corporation spending £10,000 in experiments at Canklow, and wasting the town's money in that way, when they would still have to construct the reservoir at Dalton. Mr. Mason moved, as an amendment, that the letter be referred to the Water Committee; and he remarked that he believed, if a borehole was made at Canklow, it would be found there was an abundant supply of good water there to provide the whole of the borough and a population three times as large. At the same time, he thought it desirable that the question should be discussed in Committee. Mr. Stoddart observed that they did not know what was behind Mr. Mansergh's letter; but he could quite understand that he did not care to divide the honour of carrying out the work. Mr. Hirst, replying as Chairman of the Committee, said it was true there was something behind Mr. Mansergh's letter. That gentleman had found out, in his interview with Mr. Newton, that the puddle trench for the Dalton reservoir, instead of having to go a few feet, would have to be carried down 90 feet; and this was a most serious matter. The amendment was carried by ten votes to eight.

New Water Pumping Engine at Southampton.—The Southampton Town Council have accepted a tender submitted by Messrs. J. Simpson and Co., Limited, for an additional pumping-engine, at £6703 10s. The engine is to be erected at Otterbourne; and its guaranteed coal consumption is 1·8 lbs. per actual horse power per hour.

Barnoldswick Gas and Light Company.—The Secretary and Liquidator (Mr. S. Slater) of this concern, which is being wound up because of the sale of the works and plant to the Local Board, has issued a balance-sheet, stating that he is able to pay at once £10 per share on the 1200 £10 shares of the Company, of which £6 has been paid up. The balance on revenue account for the past half year is £310; and the profit balance on the undertaking amounts to £4750. The Local Board, it may be mentioned, are securing land for an extension of the gas-works. They are endeavouring, among other things, to obtain 250 yards of land adjoining the railway-siding for the storeage of gas materials, chemicals, &c.

Sales of Shares.—Messrs. Field and Palmer, of Southsea, have recently sold the following shares in the *Portsmouth Water Company*: £10 original shares, at £28 10s. each; £5 10 per cent. shares (1861 and 1868 issues), at £14; £5 7 per cent. shares (1879 issue), at £10; ditto (new issue), with £4 paid, from £8 10s. to £9. On the same occasion, £50 "A" shares in the *Portsea Island Gas Company* realized £113 each; and £50 "C" shares produced £99 10s. and £100 apiece.——Last Tuesday Messrs. Bush and Son sold at Sheffield 126 £5 shares in the *Swinton and Mexbro' Gas Company*—97 being disposed of at £7 12s. 6d. each; and 29, at £8.——Five original ordinary 10 per cent. shares in the *Maidstone Water Company* have lately changed hands at the rate of £30 10s. per share, and five similar shares realized £1 each more.

Exhibitions of Gas Appliances.—St. Andrew's Hall, Plymouth, was occupied last week by the Carron Company, who held a highly interesting exhibition of their manufactures and minerals—comprising gas cookers, tiled grates, kitchen ranges, coal, ironstone, limestone, and pig iron. Cookery demonstrations were given daily by Miss Dudgeon, of the Leicester School of Cookery.——An exhibition of Messrs. Fletcher, Russell, and Co.'s. gas stoves and appliances has lately been held at Stockton, in which town, according to the Mayor (Mr. W. C. Langley), there are upwards of 1000 gas-stoves in use. Cookery lectures were delivered by Mrs. Young, of Warrington.——An exhibition of Messrs. John Wright and Co.'s gas-stoves (accompanied by a series of cookery lectures by Miss Shaw) was opened yesterday week in the Church Institute, Leeds, and will continue until the 16th inst.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh Town Council have fixed the price to be charged for electricity at 6d. per unit for lighting, with discounts from 1 per cent. on 1000 units to 25 per cent. on 60,000 units per annum; and at 3½d. per unit for motors. They have also appointed Mr. E. W. Monkhouse, of the Westminster Electrical Supply Corporation, London, to be Electrician to the city. In proposing approval of the charges, Mr. A. D. Mackenzie made a long speech, in which he set to himself the task of justifying the large discounts which they intend to give, as being a means of providing the light cheap to the small consumers. He said they would sink in their undertaking a capital sum of £100,000, and would have a fixed charge, whether they sold one unit or a million units, of £7622 per annum; and he proceeded: "If we assume a stage of the undertaking when we have an equivalent to 20,000 8-candle power lamps fixed, using 300,000 units per annum, we receive, at 6d. per unit (leaving the discounts meantime out of account), £7500 of a revenue, making a loss of £1312 per annum. . . . When we reach the stage of having 300,000 units sold per annum, the total cost will be £8822; while at 6d. we shall be receiving only £7500. If this output of 300,000 units can be increased to 680,000—the full capacity of the station plant as at present being installed—the additional cost will only be about 2d. per unit on the 380,000 added, or £3166; while the revenue will be increased from £7500 to £17,000. The case will then stand thus: Expenditure, £11,988—say, £12,000; revenue, £17,000. Of course, I am leaving out the proposed discounts, which would no doubt modify these figures considerably, but will not alter the argument, while showing very clearly the immense benefit of increasing the output. Professor Kennedy puts it in his report as total cost with 300,000 units, 7d.; and with 680,000 units, 4·25d. When we are then at the stage of losing £1322 per annum—or any other stage, indeed—if we have a chance of a large customer, it is clearly good policy to secure him at a reduction, in order to raise the output. Assume that we can get such a customer willing to take 60,000 units at 6d., less 25 per cent., the net cash received will be £1125. Now, what is the cost to us, exclusive of the fixed charges, which must be met whether we have him or not—say, 2d. per unit, though I believe, from my study of the matter, it will be less (the coal is calculated to cost only 0·5d. per unit, and in Glasgow it is only 0·4d.)—£500, leaving us a profit of £625, which at once reduces our loss nearly 50 per cent."

Mr. Mackenzie is about as good at figures as Mr. Gladstone was. The glamour thrown over his colleagues by such a brilliant display of results was sufficient to prevent criticism; and his postulates were accepted without comment. Suppose a little of the analytical is applied to his figures. I find from a statement he makes a little further down, that one unit will keep 50 lamps of 8-candle power alight for one hour. Assuming three hours per day as the average lighting period, that leads to this, that an installation of 50 lamps would consume, as nearly as may be, 1000 units in a year. The consumer would get a discount of 1 per cent. How many customers may be expected to keep an installation of 50 candles going constantly during the whole lighting period? Very few indeed. The great majority of the Corporation customers will be found to take much less than that. Observe, their annual account would be £25; and observe, too, the magnificent discount they would receive, which, at 1 per cent., would be five shillings. Not much encouragement to a small consumer. Suppose six consumers can be found who will take 60,000 units a year each, that would leave fully 300,000 units to dispose of to small consumers; and 300 installations of 50 lamps, constantly in use, would be required. I do not think they could be found in Edinburgh—at least I do not believe that 300 would be willing to pay the increased price for electric lighting. A good test of the probable numbers would be to find out how many persons have a yearly gas bill of £25; and then to deduct a proportion of them, to whom it would be no object to adopt the electric light. Mr. Mackenzie, I am afraid, takes too rosy a view of the prospects of electric lighting in his city. The private installation seems to be his only bugbear; and in that, without admitting it, he confesses the weakness of his proposal, which is to nobble the big consumer at the expense of the small. What a beautiful picture the scheme presents. You have the wealthy tradesman crushing his poorer neighbour by a flood of light in his premises, which the Corporation gives him at a loss. In order to reduce the loss, you have the struggling tradesman compelled to help his rival to overwhelm him; and then, beyond all that, you have the poor, who are unable to pay for electric lighting, compelled to contribute, through the rates, for the providing of it to both the other two classes. A fine position for a Corporation to occupy. If Mr. Mackenzie believes that the large consumer would not take Corporation electricity, does he not think it would be better to leave them to provide themselves, and to devote the Corporation installation to the supply of small consumers, charging them what it actually costs to produce? The point is that it would be more honourable for the Corporation to let businesses develop themselves, and not to become promoters of any adventure which is not of universal application.

One other portion of Mr. Mackenzie's speech is worthy of notice. He quoted from the JOURNAL the result of Professor Ayrton's investigations as to the light derived from gas and electric lighting, as given on Feb. 13. I believe he did it quite honestly; but it is a pity that he overlooked the explanation given in the "Electric Lighting Memoranda" of Feb. 27, that the most unsuitable gas-burner had been selected. Starting from Professor Ayrton's conclusions, he made out that in Edinburgh the cost of electricity would be equal to gas at 5s. per 1000 cubic feet. Of course, for the reason that Professor Ayrton's results are not reliable, Mr. Mackenzie's conclusion is also put out.

The Dundee Gas Commission met on Wednesday of this week. A number of contracts for retorts, bricks, &c., were agreed to. A question was put as to whether anything had been done with reference to adopting oil gas; and the reply given by the Convener of the Works Committee was that he had received a report as to the results obtained at Perth, but that no action had yet been taken. The subject, he expected, would be considered at the first meeting of the Works Committee.

The refusal of Mr. Justice Vaughan Williams to grant the petition by shareholders of the North British Water-Gas Syndicate, to have the undertaking compulsorily wound up, is a great blow to those who oppose the compulsory amalgamation, as it takes away their last hope of being able to resist the amalgamation. The scheme will now go on; and water gas will get another chance. Whether it now succeeds, time will tell; but up till now, it has been a most conspicuous failure in Scotland, as far as being a commercial commodity is concerned.

I learn that Mr. Hubert Pooley, the lately appointed Manager of the Dunfermline Gas Company, is making excellent progress with the construction of the new works; and that they may be expected to be finished about May. Thereafter the present works will be closed.

Not much has been heard of late of the Yeadon patent revolving gas-retort, of which Mr. D. M. Nelson, of Glasgow, is the sole agent; but that, I am informed, is not on account of any slackening of interest in the invention, but is accounted for by the desire of the owners of it to obtain reliable results before pushing it. They have had the retort in use continuously for over six months in a town in England where the old retorts have been entirely superseded, and all the gas consumed in that time has been produced in the revolving retort. Though the results have not yet been prepared for publication, I understand that they are considered quite satisfactory.

It is with regret that I have this week to intimate the death of Mr. R. C. Reid, C.E., the Engineer to the Edinburgh and District Water Trust. Mr. Reid was a partner of the firm of Leslie and Reid, who have held the post of Engineers since the Trust was founded. He was a son-in-law of the late Mr. James Leslie, the head of the firm, in whose office also he learned his business. A melancholy feature of Mr. Reid's removal is the fact that only three months ago, the death occurred of Mr. Alexander Leslie, C.E., his brother-in-law, and the only other partner of the firm. Knowing that his own death was a certainty in the near future, on account of a severe internal malady from which he suffered, Mr. Reid assumed as a partner Mr. James Wilson, C.E., of Greenock. But for that fact, the firm which had the largest connection in Scotland with water engineering questions, would to-day be extinct. Mr. Wilson has been temporarily appointed to advise the Edinburgh Water Trust, pending a permanent appointment, which, I understand, it is desired by some of the Trustees, should be on a different footing from that upon which it was held by the Messrs. Leslie. Mr. Reid, who has just died, was a son of the late Rev. Mr. Reid, minister of the parish of Kettle, Fifeshire. His brother, Dr. Walter Reid, is Deputy-Inspector of Hospitals in the Navy. In his day, Mr. Reid did a great deal of work in connection with his firm's engagements. Among the most recent was the Water of Leith purification scheme, which was completed last year, and an extension of the Paisley Water-Works. He was only 48 years of age. At a meeting of the Water Trust on Thursday, Lord Provost Russell said that Mr. Reid was present at their last meeting; and though somewhat ill, no one expected that he would be taken away. His death after the sudden death of his partner—both comparatively young men—was tragic. He thought all would feel with him that Mr. Reid as an adviser was as fair-minded a man as they could wish; he never knew one who was more free from prejudice.

The Falkirk and Larbert Water Trust have resolved to give a honorarium of 100 guineas to Mr. Neilson, their Superintendent. The gift is intended as remuneration for extra services rendered during the construction of the water-works, and the subsequent arbitration with the contractors. But of course the hand of the Trustees has been quickened by Mr. Neilson's energetic action recently, during the storm, when the embankment of Little Denny reservoir was threatening to give way. At the meeting this week Provost Griffiths recalled the circumstances, that while the works were in process of construction, Mr. Neilson reported on certain matters, for which he was condemned as being the originator of alarmist stories; but that what Mr. Neilson then said had come all too true. The work of strengthening the embankment of the reservoir, it was stated, has been completed according to plans by Mr. J. M. Gale, of Glasgow.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 10.

Sulphate of Ammonia.—The market, while maintaining its dull tone during the greater part of the week, exhibits a healthier feeling at the close. There are indications of a better demand; but so far the inquiries emanate principally from dealers and local consumers. Foreign buyers seem inclined to continue in their stubborn resistance to current values. The shipments are still satisfactory, and are—according to the figures published by Mr. Rhens's Statistical Bureau—11,386 tons during February this year, as against 13,366 tons during the same period in 1893. The total shipments during January, February, and March last year were close upon 40,000 tons. The shipments during January and February this year have been so far about 22,000 tons; and assuming that the consumption will eventually be on the same level as last year, about 18,000 tons will be required during March—a quantity which would exceed the stocks and the current production. The larger consumption of nitrate has been pointed out; but this does not derogate from the fact that consumers of sulphate are inadequately supplied—America, for instance, having taken only a few hundred tons against her (about) 5000 tons last spring; France, about 1500 tons, against also about 5000 tons; Spain and Italy, so far less than half their last year's requirements; and Belgium and Holland, about 7000 tons, against 12,000 tons. It may possibly be stated that no more will be required; but some anxious inquiries lead to a contrary conclusion.

LONDON, *March* 10.

Tar Products.—There is a good deal more life in anthracene, and buyers appear to have made up their minds that the general price will not be below the reasonable figure asked for it by the Tar Products Committee. Fortunately stocks are not large; and the production is a decreasing one. Buyers seem to have no faith in the value of pitch. But important shipments are being made on old contracts; and stocks in makers' hands were never so low as they are at present. In face of the decreased quantity being made, it is difficult to say how any lower price can come; and as the season advances, it will be found that the demand is in excess of the production. Benzols continue exceedingly flat; and business in them difficult, even at the quoted prices. Tar acids are firmer. Creosote and oils are in moderate request only. There is a little more inquiry for naphthalene, in various forms; but prices are ruinously low. Several tar contracts have been made at prices ranging from 12s. 6d. to 15s. 6d. Other products are quoted: Pitch, 26s. Benzols, 90's, 1s. 2d.; 50's, 1s. 4d. Creosote, 1¾d. Creosote salts, 25s. Solvent naphtha, 1s. 2d. Toluol, 1s. 6d. Cresol, 1s. 4d. Crude benzol naphtha, 30 per cent., 6¾d. Carbolic acid, 60's, 1s. 8d. Anthracene, 30 per cent., "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia, after touching £13 13s. 9d. in the early part of the week, has increased in value to £14 in all positions. The market is undoubtedly firmer to-day; and buyers' requirements appear to be urgent. The home consumption is now pressing; stocks are low; and there is no reason for the value declining for some time to come. Gas liquor is quoted at 8s. to 9s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The downward tendency in prices referred to last week continues, so far as all descriptions of round coal are concerned; and there have been further meetings of various district Committees connected with the Lancashire Coal Sales Association, with a view of a re-arrangement of list rates. In most cases, this has represented a reduction of 10d. per ton upon the different qualities of round coal; but there is a great want of regularity in quoted prices. The whole position as regards round coal could scarcely be more unsatisfactory. Whilst the Lancashire Coal Sales Association have been endeavouring to hold up prices, other districts have been cutting in and taking a large proportion of their trade; and although very few of the pits are working more than four days, stocks go on accumulating. The better qualities, suitable for house-fire purposes, hang generally upon the market; and even the lower sorts, for steam and forge purposes, are not meeting with at all a ready sale. All this is necessarily inducing buyers who have contracts to place to hold back; and so far, there are scarcely any inquiries worth noting upon the market, either for gas coal or locomotive fuel, an impression prevailing that prices are not unlikely to get down to pretty nearly as low a point as last year. So far as prices can be quoted, best Wigan Arley seems to range from 12s. 6d. up to 13s. 6d., according to the district from which it is being sent; Pemberton four-feet and seconds Arley, 11s. to 12s.; common house-fire coals, 9s. 6d. to 10s.; and steam and forge coals, 9s. to 9s. 6d. per ton at the pit mouth. The shipping business is even in a worse position than the inland trade, as not only for supplies of steam coal on the Mersey, but also for coastwise shipments, trade has been largely secured by other districts; and the Shipping Trade Committee of the Lancashire Coal Sales Association have been compelled to come down 1s. per ton upon their previous list rates—even this concession scarcely meeting the views of some of the members. Delivered at the ports on the Mersey, steam coal is now quoted at 9s. to 9s. 6d. per ton; and it is being delivered at about the same figure at the Docks in Manchester. But it seems questionable whether, even at these low prices, Lancashire coalowners will be able to recover the trade they have lost. With regard to engine classes of fuel, the depression in the round coal trade, by causing a very restricted output of slack, and consequent scarcity of supplies on the market, has the effect of hardening up prices; and in some cases advances of 3d. per ton have been quoted upon late rates. At the pit mouth, good qualities of burgy are firm at 8s. to 8s. 6d.; best qualities of slack, 6s. 3d. to 6s. 9d.; with some special sorts fetching 7s. to 7s. 3d., and common sorts not quoted under 5s. to 5s. 6d. per ton.

Northern Coal Trade.—There has been a good deal of bargaining in the Northern coal trade during the last few days; and now matters are drifting to more definite terms as to the range of prices over the summer. The Stockholm gas coal contract, too, has been decided; and this is usually one of those which are looked upon as indicating in some degree the course of prices likely to prevail. Best Northumbrian steam coal is quiet in demand; and some of the collieries have been unable to work full time, which is a position that must be expected to continue, until some of the closed ports of the North and in the Baltic reopen. The price now is weaker, at 10s. 3d. per ton f.o.b.; while some sellers are taking about 3d. per ton less. A very small part of the Danish State Railways contract for this year's supply has come to the Tyne—the price being based on 10s. per ton f.o.b. Small steam coal has now its price in part regulated by the "combination;" but it is no secret that some of the best of the Northumbrian pits are outside its operations. The prices defined by the "combination" is from 4s. to 4s. 3d., according as the collieries are classed into second or first class pits. Collieries outside ask from 3s. 9d. to 4s. 6d. per ton f.o.b. In gas coals, the demand is now a little weaker, the deliveries to the South being less; but the price is unaltered, ranging, generally speaking, from 7s. to 8s. per ton f.o.b. for odd cargoes. The Stockholm contract is allotted to the Pelton colliery again. It is for 50,000 tons; and the price delivered is 11s. 4½d. per ton. The average rate of freight last year was 4s. 1¾d. per ton; so that the price left for the coals may be estimated, though not exactly stated, as the ideas of what the freight may be this year will necessarily differ. Manufacturing coals are steady, with very little alteration. Coke is quiet, and the price of best Durham kinds is now from 13s. 6d. to 14s. 6d. per ton f.o.b. The exports have fallen considerably of late, though the local consumption is rather fuller. Gas coke shows no alteration in price this week.

Scotch Coal Trade.—There is a slight improvement in the tone of the coal market in Scotland this week. The trade, however, still continues mostly of a from-hand-to-mouth character. On account of the uncertainty as to the action of the men, coalmasters are unwilling to tie their hands by low-priced contracts; while, on the other hand,

purchasers are not eager to go into contracts, as they are not without expectation of a fall in prices. Everything depends upon the foreign demand, which, as yet, has shown no great sign of returning this season, though inquiries from abroad are plentiful. In order to induce it to come, the Fife and Clackmannan coalmasters have lowered their shipping charges by 6d. per ton. The demand for ell coal has improved. For the other varieties, it has rather slackened. The prices quoted are: Main, 7s. 3d. to 7s. 6d.; ell, 8s. 3d. to 8s. 6d.; splint, 8s. 3d. to 8s. 6d.; and steam, 9s. 3d. to 9s. 9d. f.o.b. Glasgow. The shipments during the week amounted to 124,595 tons—a decrease of 13,300 tons, as compared with the preceding week, but an increase of 20,824 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 1,142,986 tons—an increase compared with the same period last year of 272,323 tons.

Sale of the Bolton-upon-Dearne Gas-Works.—Last Thursday, Messrs. Isaac Ellis and Son offered for sale by auction at Bolton-upon-Dearne, the freehold gas-works, with cottage, buildings, &c., in that village. The property was knocked down at £1000.

Ottoman Gas Company, Limited.—The accounts of this Company for the half year ending Dec. 31 last shows that the gas-rental amounts to £8431, and the net profit to £3785. The sum standing to the credit of the profit and loss account is £4523, which the Directors recommend should be dealt with as follows: To reserve fund, £1500; to the payment of a dividend at the rate of 7 per cent. per annum on both classes of shares, £2625; and carry forward, £398.

The West Riding Water Supply Disputes.—In reference to the applications made respectively before Mr. Justice North and Mr. Justice Kekewich, as reported in last week's issue, we omitted to mention Sir George W. Morrison as one of the Counsel representing the Morley Corporation, It will be remembered that Sir George was formerly the Town Clerk of Leeds, and while in that position he took a great deal of interest in matters appertaining to water supply.

The St. Pancras Electric Lighting Loan.—Our readers may remember that the London County Council recently agreed to lend the St. Pancras Vestry £29,700, at 3½ per cent. interest, to be paid back in 25 years, for works of electric lighting. This arrangement the Vestry have declined to agree to; and they are borrowing £15,400 from the Prudential Assurance Company, at the same rate of interest, to be repaid within 42 years. The question of borrowing the remainder of the required money has not yet been decided.

The Coal-Conveying Plant at the Leigh (Lancs.) Gas-Works.—We learn that Mr. A. T. Fletcher, the Engineer of the Leigh Gas-Works, has made a great improvement in the construction and working of elevators and conveyors for the transmission of coal and other heavy material in gas-works. He found that the wear and tear of the iron skidders sliding upon the iron guides and flanges, coupled with the noise caused by this excessive friction, is a drawback to successful working. His method is to line the whole of the guides and flanges with thin strips of hard wood about ½ inch in thickness. The result has been that both the wear and tear as well as the noise have been reduced to a minimum, because the iron skidders now slide upon greasy wood. The arrangement has been "provisionally protected" by the Engineer mentioned.

Thefts from Automatic Gas-Meters.—At the Brentford Police Court, on the 27th ult., Stephen A. Hill, aged 22, a potter, of Netley Road, Brentford, was charged with having, on the 17th ult., stolen £1 3s., money belonging to the Brentford Gas Company, from an automatic gas-meter at Beatrice Villa, The Butts. He was further charged with having stolen sums of 18s. 4d. and 6s. 9d. from No. 8, Wellington Place, Hounslow, and No. 9, New Road, Brentford, respectively; he having, as was alleged, in these latter cases also, taken the money from the Company's meters. Prisoner represented himself to be a collector in the Company's service; and, having unlocked the meters by means of a false key, he abstracted the money. He had been in the employ of a firm who fitted up the meters for the Company. He was sentenced to three months' hard labour.

Laying the First Brick of the Large Gasholder Tank at the Bradford Road (Manchester) Gas-Works.—LastThursday, a number of the members of the Gas Committee of the Manchester Corporation visited the Bradford Road Gas-Works for the purpose of witnessing the laying of the first brick of the large gasholder tank in course of construction there. It is 254 feet in diameter and 50 ft. 6 in. deep; and the cost is estimated at £30,000. It will require about 5 million bricks; and 9¼ million gallons of water will be needed to fill it. It is intended to contain a three-lift holder of 7 million cubic feet capacity, which, with the inlet and outlet pipes, is estimated to cost about £36,000. The ceremony was perfored by Mr. Brooks, the Chairman of the Committee, and in the subsequent speech-making the contractor (Mr. J. Nuttall) was complimented upon the way in which he is doing his work. It is expected that the holder will be ready by the winter of next year.

Is a Gas-Works Chemist a Necessity?—This question was raised at the monthly meeting of the Burnley Town Council last Wednesday. In moving the adoption of the proceedings of the Gas and Electric Lighting Committee, Alderman Collinge called attention to the resolution to increase the salary of Mr. R. Moss, the Chemist at the gas-works, by 10s. per week. He stated that, when Mr. Moss was appointed to the position, twelve months ago, the Committee stipulated that at the end of a year they would grant him a substantial increase. Mr. Holmes moved an amendment to the effect that the matter be referred back. In doing so, he said that up to a year ago there was no such person as a chemist at the gas-works. He understood at the time that it was only a temporary experiment. Mr. Sparling, who seconded the amendment, remarked that, while the Committee were reducing wages 20 per cent. in one place, they were raising them 30 per cent. in another. Other members having spoken on the question as to whether or not a chemist was needed at the works, Alderman Collinge said that ever since he had been connected with the gas-works they had had someone to do the work that was now being done by Mr. Moss. The minutes were confirmed—only three votes being given for the amendment.

Ramsgate Water Supply.—An inquiry was recently held at Ramsgate, by Mr. Rienzi Walton, M.Inst.C.E., on behalf of the Local Government Board, into an application made by the Ramsgate Corporation for sanction to borrow £5000 for the extension of the water-works. The Town Clerk (Mr. W. A. Hubbard) appeared in support of the application, to which no opposition was offered.

Sulphur Impurities in Manchester Gas.—The question of the quality of the gas supplied to the consumers of Manchester by the Corporation has been reopened since the recent debate in the City Council on Mr. Southern's motion, and newspaper correspondence has resulted. In the course of a letter in the *Manchester Courier*, Mr. F. Scott (who is the Secretary of the Noxious Vapours Abatement Association) quotes the following passage taken from a paper read before the Manchester Literary and Philosophical Society by Dr. G. H. Bailey, of Owens College, in October last: "In March and April of last year [1892] some analyses were made of the air of Professor Dixon's room at the Owens College. The dimensions of the room are 20 feet square and 13 feet high. Three burners consuming about 12 cubic feet of gas per hour were lighted at five o'clock in the evening, and then air was aspirated from different heights in the room between the hours of seven and nine, and the sulphuric acid determined. The following were the results in parts per million: At 6 inches from the ceiling, 16·4; at 20 inches, 13·4; at 36 inches, 7·8; at 60 inches, 6·6. Thus, as a matter of fact, so enormous is the amount of sulphur in Manchester gas (it is usually at least double that allowed by the Metropolis Act as a maximum), that the air of our rooms is liable to be as highly charged with sulphurous acid as the street air is in a moderately bad fog.' Mr. Scott points out that, apart from the damage to health, &c., the gas consumers pay not only an excessive direct price for their supply, but are taxed indirectly to an amount greater probably in the aggregate than the value of the gas itself. He adds that the Noxious Vapours Abatement Association recently appealed for a special fund to enable them to provide the necessary appliances for reporting systematically to the public the quality of their gas supply; but the response indicated that the public do not apprehend fully the nature of the injury suffered by them. He says the Association is still open to undertake the work, if the means of doing so are provided.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 478.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p.c.	10	12—13	..	5 15 5
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 6
100,000	20	14 Dec.	8	Bahia, Limited	20	10½—11½	..	13 18 3
200,000	5	15 Nov.	6½	Bombay, Limited	5	4½—5	..	6 10 0
40,000	5	,,	6½	Do. New	4	3½—4	..	6 10 0
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222*	+2	5 3 7
180,000	,,	,,	8½	Do. New	100	162—167*	+2	5 1 9
220,000	Stck.	15 Sept.	11½	Brighton & Hove Original	100	210—220	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	103—106*	+2	4 14 4
320,000	20	29 Sept.	11½	British	20	46—48	..	4 13 9
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—21*	..	5 9 6
51,510	10	,,	8½	Do. 7 p. c.	10	15—16*	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5½—6½	..	3 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27*	..	5 18 6
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	253—258	+1	4 16 10
165,000	,,	,,	9½	Do. New do.	100	193—197	+1	4 16 5
160,762	,,	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	128—133	..	3 7 9
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—207	..	4 16 7
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	102—107*	..	4 13 5
486,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15½—16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	233—238	+4	5 0 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	97—100	..	4 0 0
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 12 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	173—177	+1½	3 19 1
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	270—275	..	3 12 9
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	212—217	+1	5 10 7
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109—111	..	4 10 1
541,920	20	15 Nov.	5	Monte Video, Limited	20	12¾—13¾	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6—6½	..	6 3 1
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4½	..	7 15 6
166,870	10	31 Jan.	2	Pará Limited	10	1½—2½	..	8 17 9
420,000	100	2 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	98—102	..	5 17 8
500,000	100	1 Dec.	6	2nd Do.	100	96—100	..	6 0 0
150,000	10	13 Oct.	5	San Paulo, Limited	10	8—9	..	5 11 1
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	313-318*	+5	4 17 6
1,350,000	,,	,,	12	Do. B do.	100	250-255*	..	4 14 1
260,000	,,	,,	13	Do. C do.	100	256-261*	..	4 19 7
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	150—153	..	3 5 4
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215*	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	272—277	..	3 12 3
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	218—223	..	3 11 9
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	112—116	..	3 13 4
708,000	Stck.	28 Feb.	11½	Kent	100	288—293*	..	3 18 6
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	250—255	..	3 14 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	200—205	..	3 13 2
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	130—134	..	2 19 9
500,000	100	14 Feb.	12½	New River, New Shares	100	367—372	+2	3 5 2
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	+1	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V'xnall, 10 p. c. max.	100	158—163	..	3 13 7
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	265—270	..	3 14 1

*Ex div.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO., TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

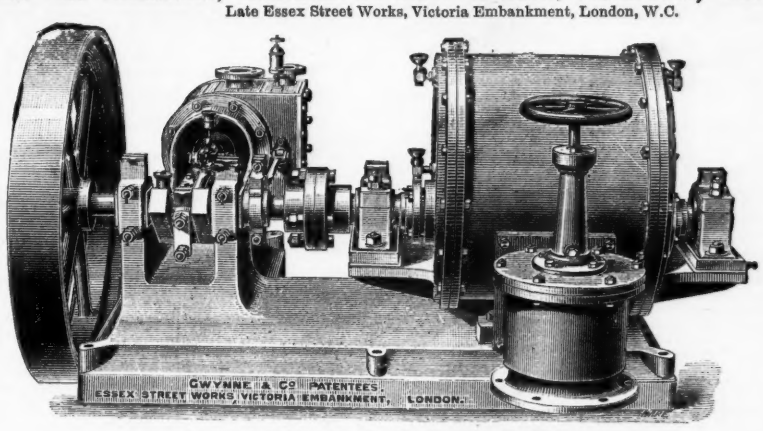
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See Advt., p. 506.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: Volcanism, London."

LIQUOR, Tar, and Spent Oxide wanted. BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

JOHN RILEY & SONS, Chemical Manu-facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 459).
Telegrams: "HUTCHINSON BROS., BARNSLEY."

A WELL-KNOWN Gas Expert, shortly disengaged, is open to engage with a good firm of Gas Engineers as REPRESENTATIVE at home or abroad.
Reply, stating terms, &c., to No. 2351, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO ENGINEERS AND MANAGERS.

WANTED, by the Son of a Water-Works Engineer, a Situation as ASSISTANT or otherwise, in the Office of a Water-Works Engineer or Manager. Has had four years' experience on Public Works and in General Office Routine. No objection to going abroad.
Address ENGINEER, Water-Works, PORTSMOUTH.

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. III., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
70, Chancery Lane, LONDON, W.C.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

TO GAS-STOVE MAKERS.

WANTED, a re-engagement as TRAVELLER. Moderate Salary and Expenses.
Apply, by letter, to No. 2354, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Gas Engineer, an En-gagement Abroad. Has had eight years' experience in South America as Engineer and Manager.
Apply, by letter, to No. 2355, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Mechanic in Gas-Works by a good all-round Man. Twenty years' experience in erecting at home and abroad. Good references.
Address No. 2357, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

DRAWINGS, Tracings, Specifications, Quantities, Strains, &c., prepared by an experienced Gas-Engineering Draughtsman. Plans of Works made, copied, or enlarged. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. H. OPPENHEIM, 27, FORE STREET, E.C.

WANTED, by a competent Man, a Situation as SERVICE LAYER, METER FITTER, INDICE READER, STOVE FIXER, &c. Total Abstainer.
Address No. 2349, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser (age 30), a Situation as METER INSPECTOR, METER FIXER, STOVE FITTER, &c. Now employed in large Provincial Works.
Address A. B., care of Mr. R. Richardson, 11, Terminus Place, EASTBOURNE.

TO GAS MANAGERS.

WANTED, by the Son of a Gas Engi-neer and Manager (age 18), a Situation at a small Gas-Works as COLLECTOR and METER INDICE TAKER; also understands the keeping of Gas Company's Books, &c. Lifetime experience in same.
Address No. 2356, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Gas Manager. Thorough knowledge of the Manufacture and Distribution of Gas from Retort to Burner, also the Manufacture of Sulphate of Ammonia. At present in a Works making over 21 millions. Has been in present employ thirteen years. Married. Good reasons for leaving. Also good Testimonials. Disengaged March 9.
Address No. 2342, care of Mr. King, 11, Bolt Court FLEET STREET, E.C.

WANTED, a good Bookkeeper for a Gas-Works in Brazil. Passage paid out and home; but the engagement may be only for a short period.

Address, stating previous occupation, age, and salary required, to G. A. S., Messrs. Deacon's, LEADENHALL STREET, E.C.

AGENT WANTED.

ESTABLISHED Firm of Importers would appoint first-class AGENT having strong influence with London Gas Companies. The quality is the finest in the market. Liberal terms.

Address, No. 2350, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Pemberton Local Board, a qualified person to act as GAS EXAMINER under the power of the Gas-Works Clauses Act, 1871.

Applications to be sent to the undersigned not later than the 22nd inst.

P. PARTINGTON, Clerk.

WELLINGTON (SALOP) COAL AND GASLIGHT COMPANY.

WANTED, an Accountant and Manager.

Particulars from the undersigned.

Applications, with copies of three recent testimonials, to be sent by the 24th inst., endorsed "Gas Manager" (canvassing will disqualify), to G. BIDLAKE, Secretary, Town Hall Chambers, Wellington, SALOP.

March 9, 1894.

GAS-FITTER.

WANTED, a thoroughly good Gas-Fitter and METER INSPECTOR for a large Provincial Gas Company. He must be experienced in all branches, and of good address. Applicants with knowledge of electrical work preferred. Permanent Situation.

Address full particulars to No. 2358, care of Mr. King, 1, Bolt Court, FLEET STREET, E.C.

SLOUGH GAS AND COKE COMPANY.

WORKING Manager required. Annual make about 19 millions. Wages to commence £2 per week. House, large Garden, Coals, and Gas free.

Applications, with not more than three recent testimonials, addressed to the Chairman, R. Martin, Esq., Castleview, Chalvey, near Slough, endorsed "Application for Manager," to be delivered on or before Tuesday, the 20th inst.

ARTHUR THOMAS, Secretary.

Feb. 28, 1894.

WANTED, Smeaton's W.C. Climax BASINS. Say lowest price.

Address REEVES-SMITH, Seaford, SUSSEX.

WANTED, two 4-inch Four-Way VALVES, 12 inches from Flange to Flange, each side. Guaranteed in good order and gas-tight.

State lowest price to WILLIAM KEOGH, Manager, Gas-Works, KILLARNEY.

FOR SALE—One 6-inch Station Governor. Removed for larger one.

Particulars of H. WIMHURST, Gas-Works, SLEAFORD.

OSWESTRY GAS COMPANY.

TENDERS are invited by the above Company for the supply and delivery at Oswestry of about 450 yards of 12-inch CAST-IRON MAINS and requisite SPECIALS.

TENDERS are also invited for LAYING the above.

Further Particulars may be had from the undersigned.

J. H. PARSONS, Manager.

TO IRONFOUNDERS AND OTHERS.

THE Gas Committee of the Keighley Corporation are prepared to receive TENDERS for HYDRAULIC MAINS, FOUL MAINS, and RETORT-FITTINGS complete for 180 Mouthpieces.

Drawings can be seen, and Copies of Specification and Quantities obtained, at the Gas Offices, Low Bridge, Keighley, where tenders must be delivered, endorsed "Tender for Retort-Fittings," and addressed to the Chairman of the Gas Committee, on or before Monday, the 26th inst.

By order,
JOHN LAYCOCK, Engineer.

TO BRICKLAYERS.

THE Gas Committee of the Keighley Corporation are prepared to receive TENDERS for the erection (labour only) of Two RETORT STACKS, of five through Arches each, with Main Flues and Chimney.

Drawings and Specification can be seen at the Gas Offices, Low Bridge, Keighley, where tenders must be delivered, endorsed "Tender for Brickwork," and addressed to the Chairman of the Gas Committee, on or before Monday, the 26th inst.

By order,
JOHN LAYCOCK, Engineer.

TENDERS FOR GAS COAL.

THE Gas Committee of the Corporation of Haverfordwest are prepared to receive TENDERS for the supply of about 1400 tons of the best screened WIGAN, ARLEY, or SILKSTONE GAS COAL, to be delivered by water carriage at their Quay at Haverfordwest, in such quantities as may be required, for the period of Twelve Months from the 25th of March inst.

Payments will be made in cash every month (subject to stipulations).

Sealed tenders to be sent in not later than the 17th of March inst.

Forms of Tender on application to Mr. HENRY DAVIES, Town Clerk, HAVERFORDWEST.

March 1, 1894.

CORPORATION OF ROTHERHAM.

TENDERS FOR FIRE GOODS.

THE Gas Committee are prepared to receive TENDERS for the supply of RETORTS, FIRE-BRICKS, and FIRE-CLAY.

Further particulars on application to the Engineer, Mr. C. B. Newton.

Tenders, endorsed "Tender for Fire Goods," to be delivered to the undersigned not later than Wednesday, the 21st inst.

By order,
H. H. HICKMOTT, Town Clerk.

Council Hall, Rotherham,
March 9, 1894.

SHEFFIELD UNITED GASLIGHT COMPANY. NEEPSEND STATION.

TO IRON ROOF CONTRACTORS.

THE Directors of this Company invite TENDERS for the construction and erection of a WROUGHT-IRON HIPPED ROOF, 52 feet long by 43 feet span, over Boiler-House at their Neepsend Station.

Copy of the Drawing and Specification may be obtained upon application to the Engineer (Mr. Fletcher W. Stevenson), on payment of 10s. 6d. (not returnable).

Sealed tenders, endorsed "Tender for Roof," must be delivered to the undersigned (by post), at the Company's Offices, on or before Saturday, the 31st day of March.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS, General Manager.

Commercial Street, Sheffield,
March 10, 1894.

SHEFFIELD UNITED GASLIGHT COMPANY. NEEPSEND STATION.

TO BOILER MAKERS.

THE Directors of this Company invite TENDERS for the manufacture and delivery at their Neepsend Works of three LANCASHIRE STEEL BOILERS, each 30 feet long by 7 ft. 6 in. diameter.

Copy of the Drawing and Specification, with Form of Tender, may be obtained upon application to the Engineer (Mr. Fletcher W. Stevenson), on payment of 10s. 6d. (not returnable).

Sealed tenders, endorsed "Tender for Boilers," must be delivered to the undersigned (by post), at the Company's Offices, on or before Saturday, the 31st day of March.

The Directors do not bind themselves to accept the lowest or any Tender.

HANBURY THOMAS, General Manager.

Commercial Street, Sheffield,
March 10, 1894.

GLASGOW CORPORATION GAS.

TAR AND AMMONIACAL LIQUOR FOR SALE, AND RESIDUAL PRODUCT WORKS TO LEASE.

THE Glasgow Corporation Gas Com-missioners are prepared to receive TENDERS for (1) the purchase of the TAR and AMMONIACAL LIQUOR produced at the DALMARNOCK GAS-WORKS from and after July 1, 1894; (2) the purchase of the TAR and AMMONIACAL LIQUOR produced at the DAWSHOLM and TEMPLE GAS-WORKS from and after July 1, 1894, and a LEASE of the RESIDUAL PRODUCT WORKS belonging to the Commissioners adjoining these Gas-Works from and after same date; (3) the purchase of the TAR and AMMONIACAL LIQUOR produced at the TRADESTON GAS-WORKS from and after July 1, 1894, and a LEASE of the RESIDUAL PRODUCT WORKS belonging to the Commissioners adjoining these Gas-Works, from and after same date; and (4) the purchase of the TAR and AMMONIACAL LIQUOR produced at the POLLOKSHAWS and OLD KILPATRICK GAS-WORKS from and after May 15, 1894.

Forms of Tender, on which offers must be made, and copies of the "Terms and Conditions" upon which the Tar and Liquor are to be sold and the Works are to be let, may be had on application to the Manager at the Gas Office, 45, John Street, Glasgow; and offers, endorsed "Tenders for Tar and Ammoniacal Liquor, &c.," will be received by the subscriber on or before Tuesday, the 20th of March next.

The Commissioners do not bind themselves to accept the highest or any tender.

J. D. MARWICK, Town Clerk.

City Chambers, Glasgow,
Feb. 24, 1894.

OTTOMAN GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY MEETING of the Shareholders in the above Company will be held at the Offices of the Company, 9, Queen Street Place, Cannon Street, E.C., on Tuesday, March 20, at One o'clock, for the purpose of receiving a Report and Statement of Accounts from the Directors for the Half Year ending Dec. 31, 1893.

The Transfer Books will be closed from March 13 to 20, both days inclusive.

By order,
ARTHUR J. KING, Secretary.

9, Queen Street Place, Cannon Street, E.C.,
March 6, 1894.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office, on Wednesday, the 21st inst., at half-past Twelve o'clock precisely, to transact the usual Business, and to declare the Dividend for the Half Year ended the 31st of December last.

Notice is hereby also given, that the Transfer Books of the Company will be closed on the 10th, and re-opened on the 22nd inst.

By order of the Court of Directors,
FREDERIC LANE LINGING, Secretary.

Chief Office: 11, George Yard, Lombard Street,
London, E.C., March 2, 1894.

SOUTHEND GAS COMPANY.

NOTICE is Hereby Given, that the ANNUAL ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Company's Offices, No. 52, High Street, Southend, Essex, on Wednesday, the 28th of March inst., at Two o'clock precisely, to receive the Report of the Directors and the Statement of Accounts for the Year ended the 31st of December, 1893, to declare a Dividend, to elect two Directors and one Auditor retiring by rotation, to submit for approval a resolution for determining the Salary of the Secretary, and to transact such other business as the Act of Parliament directs.

The Transfer Books will be closed from the 14th until the 30th inst., both days inclusive.

By order of the Board,
JAMES T. RANDALL, Secretary.

Offices of the Company: No. 52, High Street,
Southend-on-Sea, March 8, 1894.

SOUTHWARK & VAUXHALL WATER COMPANY.

SALE BY TENDER OF £75,000 FOUR PER CENT. DEBENTURE STOCK.

NOTICE is Hereby Given, that it is the intention of the Directors of the Southwark and Vauxhall Water Company to SELL by TENDER, to be received at the Company's Office, Southwark Bridge Road, S.E., not later than Twelve o'clock noon, on Tuesday, the 20th day of March, 1894, £75,000 DEBENTURE STOCK of the Company.

The Stock now for sale is the second portion of the sum of £300,000 of Debenture Stock, authorized to be raised by the Southwark and Vauxhall Water Act, 1891, and will be entitled on and from the 31st of March, 1894, to interest at the rate of 4 per cent. per annum. It will be consolidated with the Company's existing 4 Per Cent. Debenture Stock, and will rank before the whole of the Company's authorized Stock and Share Capital, now amounting to £1,518,000, the whole of which is paid up, and the Interest thereon will have priority of payment over all Dividends or Interest on such Capital, and will rank *pari passu* with the Interest on all the Company's existing Debenture Stock.

For Particulars, Forms, and Conditions of Tender, apply at the Office of the Company, Southwark Bridge Road, S.E.

By order of the Board of Directors,
ALFRED JELLEY, Secretary.

Southwark Bridge Road, S.E.,
March 5, 1894.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS

JAMES WHITE & Co., Limited,

ALBERT WORKS, WIDNES.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,

FITTER.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

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Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
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Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

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Tudhoe Gas-Works,

Spennymoor,

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MESSRS. The

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Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13¼ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	PER CENT.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,

Yours truly,

A. B. COWAN,

Manager.

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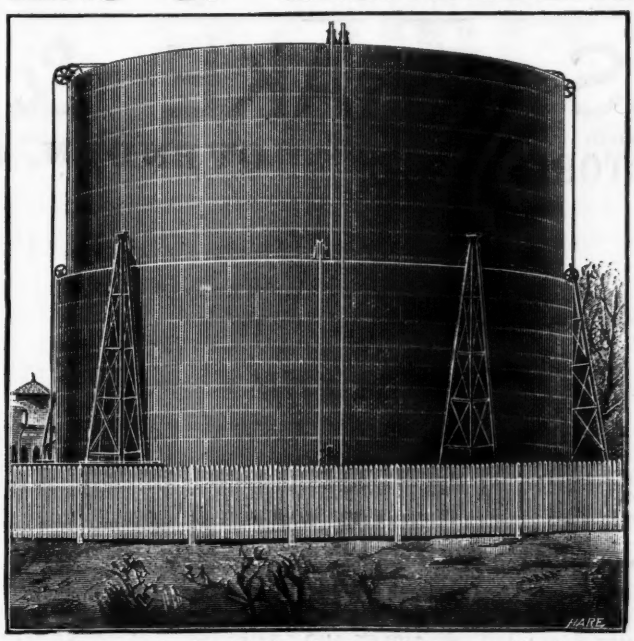

WIRE ROPE SYSTEM

This Engraving is taken from a Photograph of a Holder **increased in capacity from 32,000 cubic feet to 59,000 cubic feet** by the addition of a Lift. The Ropes are applied to both Lifts to supplement the Standards.
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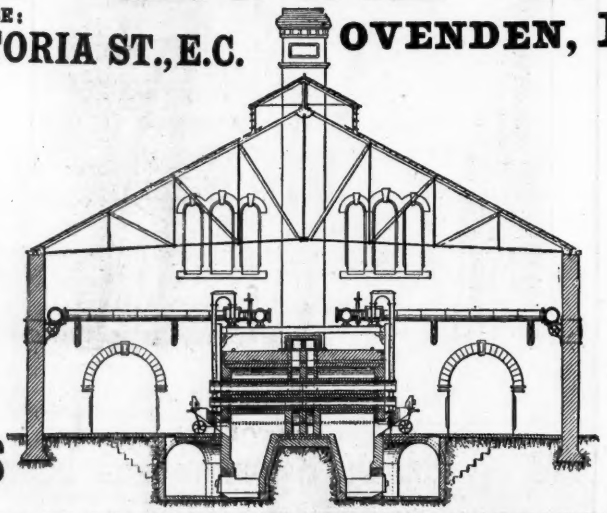

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,,	6	,, ,,	6	,, ,,	OCTOBER,	1893.
LUTON	2	,, ,,	6	,, ,,	DECEMBER,	1892.
,,	3	,, ,,	6	,, ,,	SEPTEMBER,	1893.
LITTLEHAMPTON	1	BED ,,	4	,, ,,	MAY,	1893.
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,,	1	,, ,,	7	,, ,,	SEPTEMBER,	1893.
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,,	1	,, ,,	6	,, ,,	JULY,	1893.
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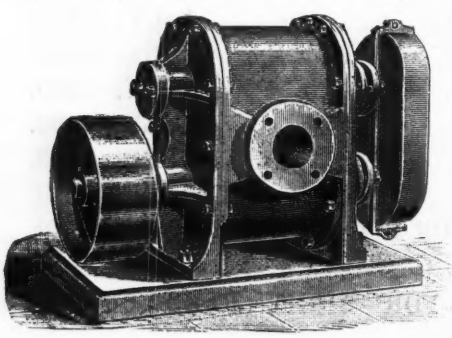

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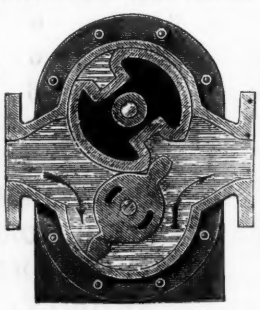

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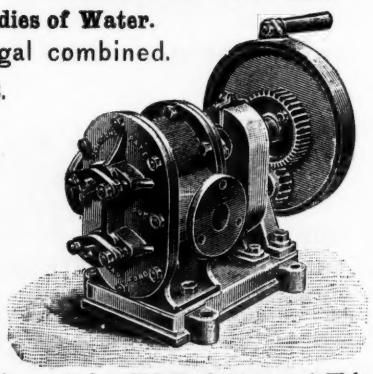

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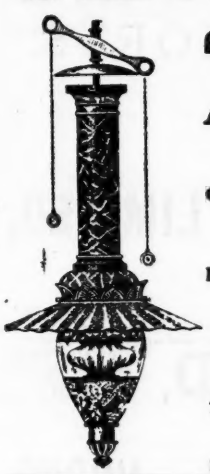

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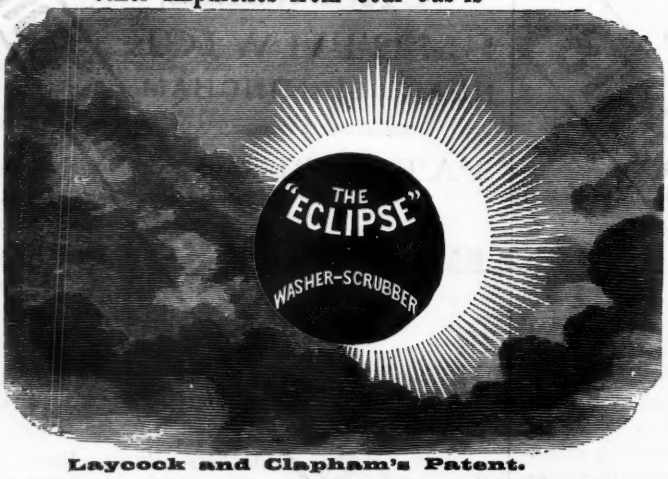

Laycock and Clapham's Patent.

The Patent Wooden Balls thoroughly break up the Gas; give an immense amount of freshly-wetted Surface; and do not clog or increase back pressure.

Whilst the Gas is passing through and amongst the Balls, it is continually showered upon by the contents of Buckets.

The Shaft Revolves in Improved Bearings, and all Workings are accessible.

REPAIRS AND TROUBLE REDUCED TO A MINIMUM.

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PURIFIERS,

With Lutes Cast and Planed Joints,

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VALVES,

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